2012 Update to the 2009 Wastewater Facility Plan Amendment

For

City of Coeur d'Alene Wastewater Department

February 2012

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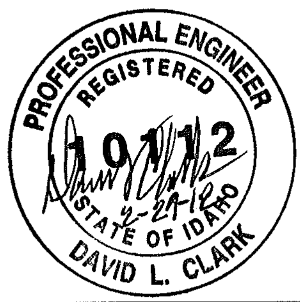

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ATTACHMENT B

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9.1 Introduction

The 2009 Wastewater Facility Plan Amendment was approved by the Idaho Department of Environmental Quality (DEQ) and served as an update to the 2000 Wastewater Facility Plan and the 2002 Predesign Report for the Coeur d'Alene Wastewater Treatment Plant Phase 4B/4C Expansion. The focus of the 2009 Wastewater Facility Plan Amendment was on the evaluation of treatment alternatives for compliance with the Spokane River dissolved oxygen total maximum daily load (TMDL) being prepared by the Washington Department of Ecology. Of particular importance was the evaluation of treatment technologies capable of achieving an effluent phosphorus concentration of less than 0.050 mg/L. Much of the past facility planning analysis remains unchanged by new discharge conditions on the Spokane River and is retained as the basis for the City's overall wastewater management program. The 2000 Wastewater Facility Plan and 2009 Wastewater Facility Plan Amendment provide a flexible, long-term management strategy for Coeur d'Alene, while identifying a phased implementation program to meet capacity and treatment requirements into the future. This Chapter 9 is a supplement to the 2009 Wastewater Facility Plan Amendment and is intended to reflect changes to Coeur d'Alene's wastewater program since the 2009 Wastewater Facility Plan Amendment was prepared.

The previous 2000 Wastewater Facilities Plan identified the need for reliable compliance with ammonia nitrogen limits and the need for addressing treatment improvements necessary to accommodate projected wastewater flow. Treatment improvements were identified for the secondary liquid stream treatment process and the solids stream anaerobic digestion and sludge storage processes. The 2009 Wastewater Facility Plan Amendment called for improvements to be in place when the nominal plant flow reaches 4.2 million gallons per day (mgd) since that was the estimated threshold for flows and loadings to meet summer effluent ammonia nitrogen discharge limitations within the existing treatment process. The improvements identified as Phase 4C in the 2000 Wastewater Facility Plan were re-packaged and re-labeled in the 2009 Wastewater Facility Plan Amendment as Phase 5B and Phase 5C. The City's currently planned improvements are very similar to the improvements proposed in the 2000 Wastewater Facilities Plan and have been updated to include new ammonia nitrogen, CBOD, and phosphorus reduction requirements.

The most urgent Phase 5 improvements currently under construction are related to solids processing, and in particular, anaerobic digestion capacity. The 2009 Phase 5 Preliminary Design Report focused on establishing the design criteria, site layouts, cost opinions for the Phase 5 improvements, with an understanding that selection of one of the three liquid stream treatment options carried forward from the 2009 Wastewater Facility Plan Amendment would be implemented upon completion of further studies.

A key aspect of the City's wastewater program that has informed the discussion of liquid treatment process options is the Low Phosphorus Demonstration Pilot Testing (Pilot) Facility recommended in the 2009 Wastewater Facility Plan Amendment. The focus of the demonstration testing effort is to address questions regarding the full-scale performance and reliability under variable influent flows and loads beyond those explored in the limited duration 2006 pilot testing program. To date, no full-scale experience exists with very low effluent phosphorus treatment technologies with facilities of comparable size and similar water quality to Coeur d'Alene. The demonstration pilot testing program is being used by the City to investigate three candidate low phosphorus treatment technologies under variable flow and loading conditions and operated by plant staff. This demonstration testing will deliver valuable information not only with respect to meeting low effluent phosphorus, but also in determining operating strategies, troubleshooting guidelines, plant maintenance requirements, and more accurate information on critical design parameters. Final selection of the treatment technology for low effluent phosphorus will be made based on the results of the demonstration pilot testing program and this wastewater facility plan update.

The demonstration pilot testing facility has been in continuous operation since July 2010, following a start-up and optimization period from May through June 2010. The capability of each candidate treatment process to attain effluent total phosphorus concentrations of less than 0.050 mg/L is being evaluated. Preliminary results from the first year of testing and operation indicate the potential for the treatment processes to be optimized for application in Coeur d'Alene and potentially implemented at less cost than originally estimated. The opinion of probable project cost estimated in the Phase 5 Preliminary Design Report has projected the Phase 5C improvements to cost in the range of $44 million to $66 million (December 2011 dollars).

This chapter of the facilities plan serves as an update to the 2009 Wastewater Facility Plan Amendment and focuses on items that have changed since the 2009 Wastewater Facility Plan Amendment. Key elements of this supplemental chapter include the following:

- Updated effluent wastewater characteristics
- Regulatory updates
- Solids stream process updates
- Selection of the liquid stream process
- Site plan updates

The section numbers in Chapter 9 correspond with the original chapter numbers in the 2009 Wastewater Facility Plan Amendment, which is being retained, to aide reviewers in tracking updates.

9.2 Flow and Wasteload Projections

Updates in this section of the Chapter 9 supplement include a description of improvements to the wastewater treatment plant since the preparation of the 2009 Wastewater Facility Plan Amendment. An assessment of the associated performance in this period is also included. Additional ammonia nitrogen reduction improvements, solids stream capacity improvements, and the Low Phosphorus Demonstration Pilot Testing Facility have been constructed since 2008. The projected wastewater flows and loads will not be updated in this section because this chapter is a supplement to the 2009 Wastewater Facility Plan Amendment, which included a review of flows and loads.

9.2.1 Summary of Plant Improvements from 2008 to 2011

Since June 2008, the following improvements have been implemented at the treatment plant:

- Near term ammonia nitrogen reduction improvements, including:
    - Installation of five integrated fixed film activated sludge (IFAS) modules to supplement nitrification capacity as a full-scale “pilot” test application of the technology. This was the first known application of IFAS to a trickling filter/solids contact treatment process.
- Phase 5A upgrades were constructed in 2009 and included the following:
    - Based on successful piloting of IFAS media in 2008, an additional five IFAS modules were installed to further supplement nitrification capacity.
    - A rotary screen thickener (RST) was installed to thicken waste secondary sludge (WSS) and eliminate limitations in co-thickening of primary and waste secondary sludge in the gravity thickeners.
- The Low Phosphorus Demonstration Pilot Testing Facility was constructed in 2009, including:
    - Dual-stage Upflow Sand Filtration
    - Tertiary Membrane Filtration (TMF)
    - Membrane Bioreactor (MBR)
    - Ultraviolet disinfection (for demonstration of recycled water use)
    - Extensive online monitoring and analytical testing equipment
- Phase 5B upgrades were constructed in 2010 to 2011 and included:
    - New Administration/Laboratory Building
    - Collections Maintenance Garage
    - Digester Control Building
    - Biogas Control Building
    - Anaerobic Digester 5
    - Utilidor extension for process piping and plant utilities

- Power supply, instrumentation, and controls for the new buildings, unit treatment processes, and equipment

These facilities are described in more detail in Section 9.4.

9.2.2 Wastewater Treatment Plant Performance

The 2009 Wastewater Facility Plan Amendment included an assessment of wastewater treatment plant operations performance data from January 2000 through December 2008. For this 2012 update, the performance data assessment was extended from January 2009 through October 2011. To illustrate trends from the 2009 Wastewater Facility Plan Amendment and recent plant performance, data from January 2006 through October 2011 are shown in Figure 9-1 through Figure 9-16.

The installation of additional IFAS modules and operational enhancements (e.g., equalization of solids dewatering return over a 24-hour period) over the past two years has improved nitrification performance in the summer months. The addition of the Low Phosphorus Demonstration Pilot Testing Facility with online monitoring has provided the operations staff a real-time view of full scale plant performance data (PO_4-P, NH_4-N, NO_3-N, and pH) for the primary and secondary treatment systems, since these were used as the feed sources to the Low Phosphorus Demonstration Pilot Testing Facility. This real-time plant performance data provided operators more timely information to better control the full-scale plant.

9.2.2.1 Primary Clarifier Performance

Primary clarifier performance has remained consistent over the period of evaluation and is currently sufficient to meet process performance objectives based on recent data. One significant primary clarifier upset occurred December 12, 2008. The clarifier drive failed and resulted in an overflow of solids from the clarifier. The operators were able to repair the drive in a single day; however, the piping from the bottom of the clarifiers to the primary waste pumps was partially plugged with a heavy accumulation of solids. Plant process water (chlorinated effluent) was added to the primary waste pump intakes to flush out the solids and as a result, the system did not return to normal operation until the end of January 2009. During this time, plant process water was used to reduce the floating sludge, which resulted in substantial solids overflow of the weirs and an increase in primary effluent solids, as shown in Figure 9-1.

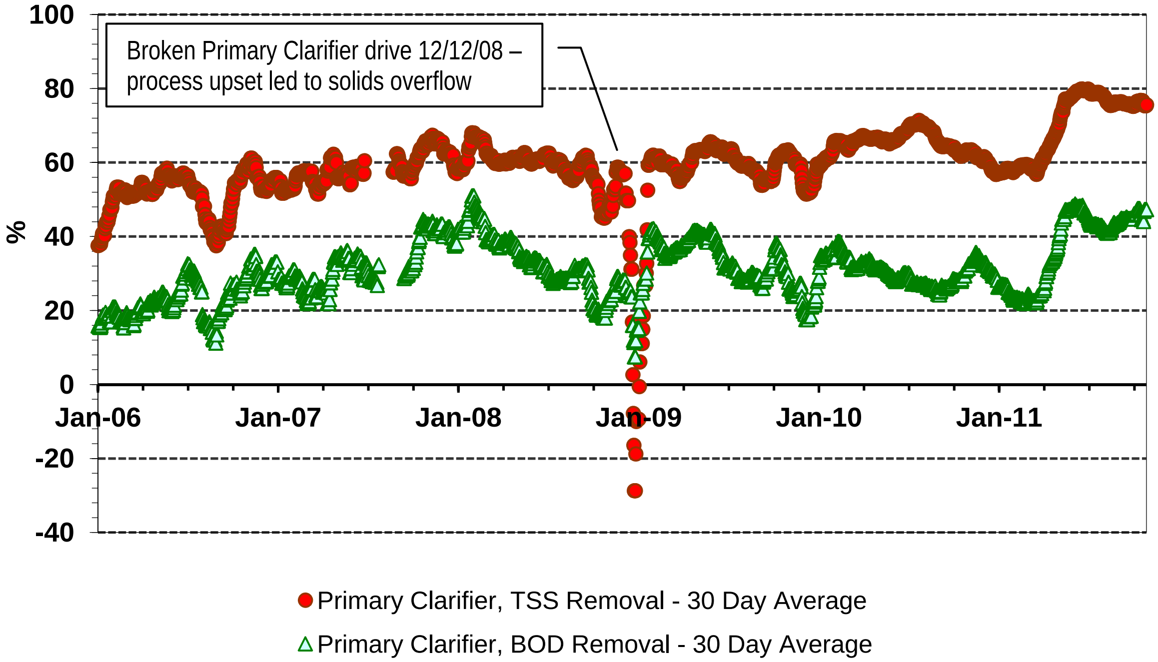

Figure 9-1. Primary Clarifier BOD and TSS Removal – 30-Day Averages

9.2.2.2 Secondary Clarifier Performance

The secondary clarifiers continue to produce effluent total suspended solids (TSS) typically less than 20 mg/L TSS. Maintenance was performed on Secondary Clarifier No. 1 from the end of 2009 through March 2010. During this period, effluent solids from Secondary Clarifier No. 2 increased, as shown in Figure 9-2. Secondary Clarifier No. 2 was temporarily removed from service for maintenance at the end of 2010 and returned to service in March 2011. This led to a second effluent solids peak in 2011 as shown in Figure 9-2. During operation of the Low Phosphorus Demonstration Pilot Testing Facility, polymer addition to the secondary clarifiers was suspended for about three weeks in March and April 2011. This led to the third increase in effluent solids in 2011 shown in Figure 9-2.

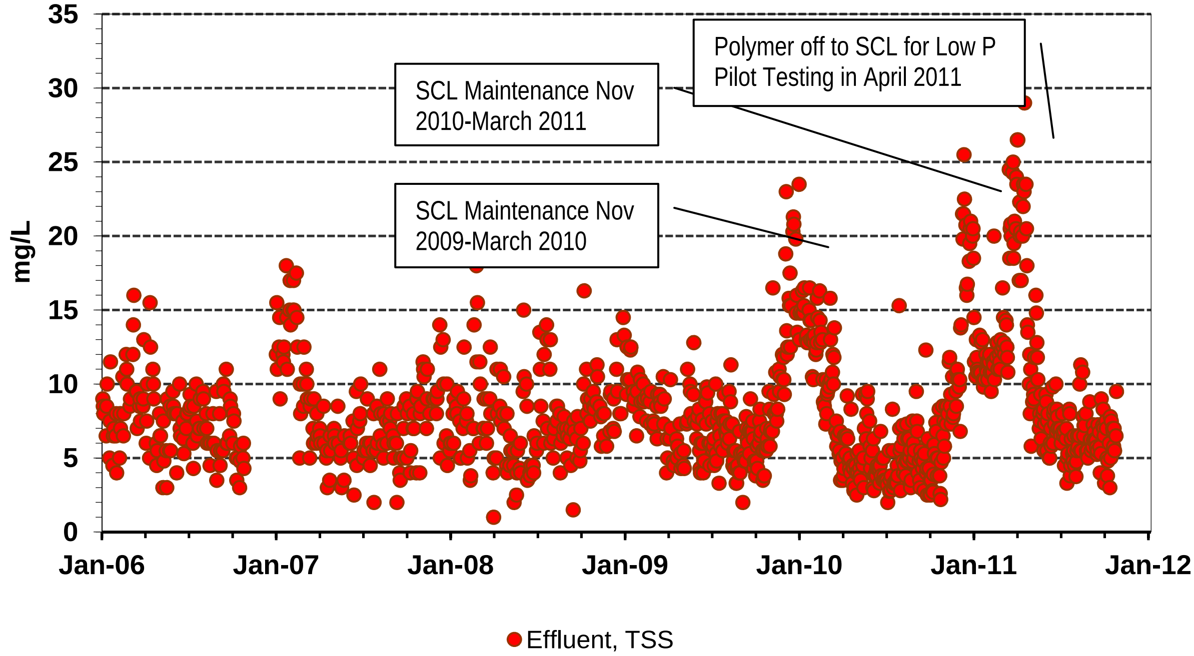

Figure 9-2. Effluent Total Suspended Solids

9.2.2.3 Ammonia Nitrogen Reduction

The ammonia nitrogen reduction performance has improved from 2006 through 2011 due to process improvements and operational changes. The City's current NPDES permit includes effluent ammonia nitrogen limits of 10 mg/L when flows are less than 4.2 mgd and 7.4 mg/L when flows are higher than 4.2 mgd from July through September. These effluent ammonia limits and increasing plant flows led to the addition of IFAS media in the solids contact/reaeration basins to fortify nitrification capacity.

The initial installation of five IFAS modules was completed in 2008 followed by a second retrofit to add five more modules in 2009. While the IFAS modules added nitrification capacity, operation was interrupted during construction and ammonia nitrogen reduction was temporarily impaired at the beginning of the 2009 permit season due to the lower mixed liquor concentration that had to be maintained because of the lack of redundant clarifiers. The summer of 2010 was the first effluent ammonia nitrogen limit season that operated uninterrupted since IFAS was first installed. Monthly average effluent ammonia nitrogen concentrations decreased from 2008 to 2010, as shown in Figures 9-3 and 9-4. The effluent ammonia nitrogen concentration increased from 2010 to 2011(**Figure 9-3**) and colder wastewater temperatures in the spring of 2011 are thought to have reduced nitrification performance.

The average effluent ammonia nitrogen concentration by month for June, July, and August is shown in Figure 9-4. Current effluent discharge permit limits for ammonia nitrogen apply from July through September. The monthly average effluent ammonia nitrogen concentrations in July through September 2011 are less than the 10 mg/L limit. As flows increase, the City will be faced with the lower effluent limit of 7.4 mg/L. Additionally, as influent carbonaceous biochemical oxygen demand (CBOD) loading increases and nitrification currently experienced in the Trickling Filters is reduced or eliminated, ammonia nitrogen loading to the solids contact process will increase and ammonia nitrogen reduction through the plant will be impacted. Based on the current monthly average effluent concentrations, additional nitrification capacity is required to meet the lower effluent limit.

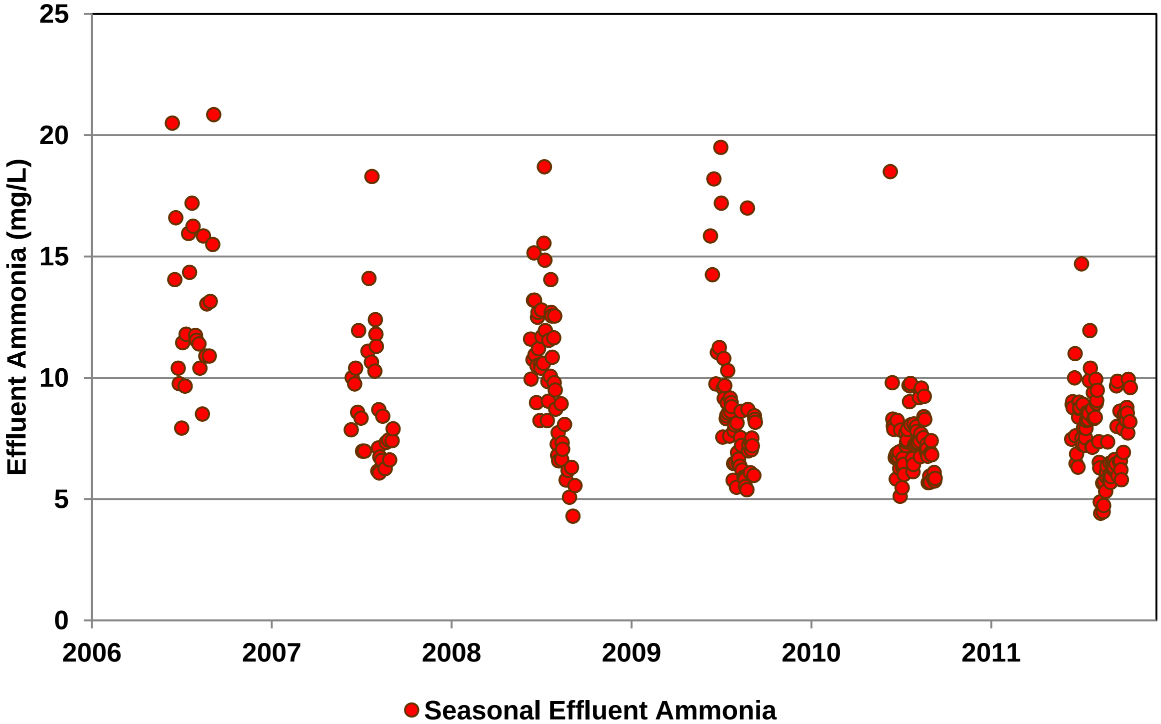

Figure 9-3. Daily Effluent Ammonia Nitrogen Concentrations for July 1 to September 30

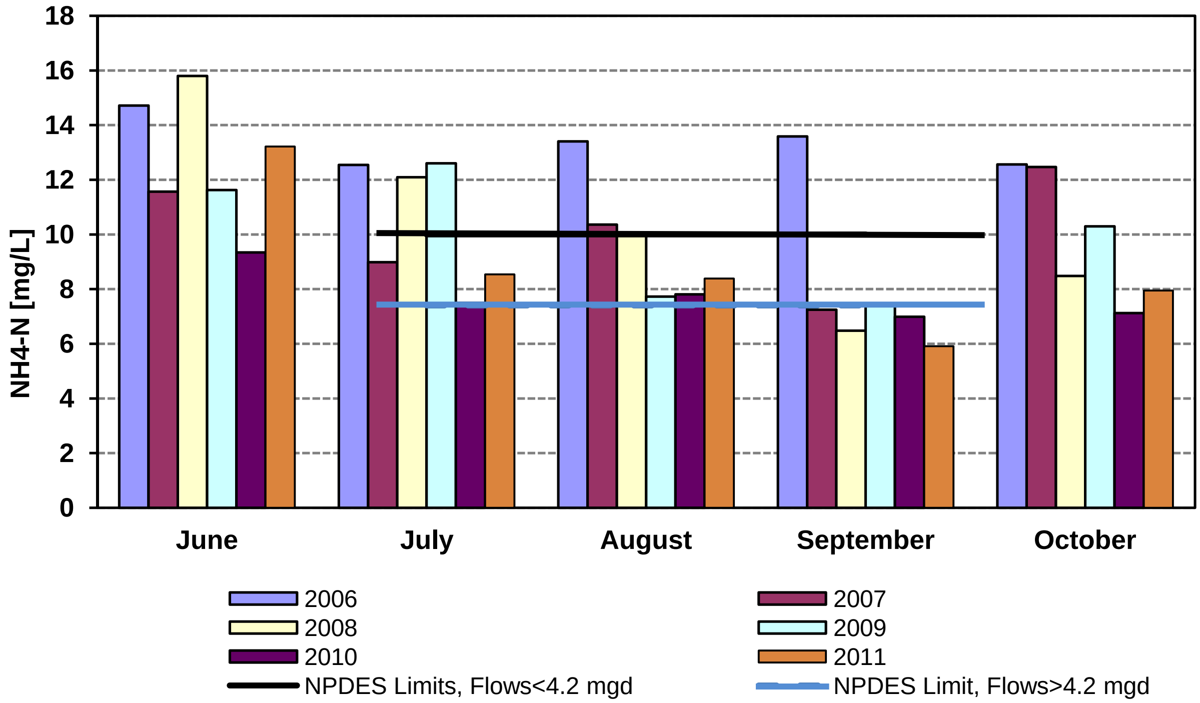

Figure 9-4. Monthly Average Ammonia Nitrogen Concentrations (2006-2011)

9.2.2.4 Phosphorus Removal

Phosphorus removal at the wastewater treatment plant is achieved by alum addition during the phosphorus removal season. The current NDPES permit requires phosphorus removal "during the critical time period each year" based on an assessment of conditions in Lake Spokane.

The effluent phosphorus performance from April through October for 2006 through 2011 is shown in Figure 9-5. Under the current NPDES discharge permit, effluent phosphorus limits of 1 mg/L or 85 percent removal, whichever is greater, apply between March 1 and October 31. The start and end dates for the phosphorus removal season is determined annually based on river flows. In 2011, the phosphorus removal season started on May 4. The phosphorus season start and end dates from 2006 through 2011 are shown in Table 9-1.

Table 9-1. Coeur d'Alene Phosphorus Season Annual Start and End Dates

Year	Start Date	End Date[1]
2006	April 27	October 15-31
2007	April 23	October 15-31
2008	May 7	October 15-31
2009	May 1	October 15-31
2010	May 26	October 15-31
2011	May 4	October 15-31

[1]The exact end date for the phosphorus removal season each year is documented function of instream phosphorus testing upstream of Long Lake and projected flow at the City of Spokane Riverside Park Water Reclamation Facility. Because of this, the October monthly average calculation is from October 1 through October 15.

Based on the phosphorus season start dates in Table 9-1 and the effluent phosphorus concentrations and percent removal in Figure 9-5 and Figure 9-6, the City had no excursions from its NPDES phosphorus limits in all months except April 2006, August 2007, and July 2008. Generally, phosphorus removal is consistent throughout the permit season.

Effluent total phosphorus concentrations in April 2011 were elevated compared to previous years. Polymer addition to the secondary system was suspended for three weeks in March and April 2011 to support testing in the Low Phosphorus Demonstration Pilot Testing Facility. This was done so that secondary effluent conveyed to the pilot facility would be free of polymer. The polymer works to trap and settle solids, which include a fraction of particulate phosphorus. During the time when the polymer feed was suspended, the effluent solids increased (Figure 9-2). This process change possibly led to the higher than normal effluent total phosphorus in April 2011 shown in Figure 9-5. The average monthly effluent phosphorus concentrations during the phosphorus removal season, from April through October (2006-2001) are shown in Figure 9-5.

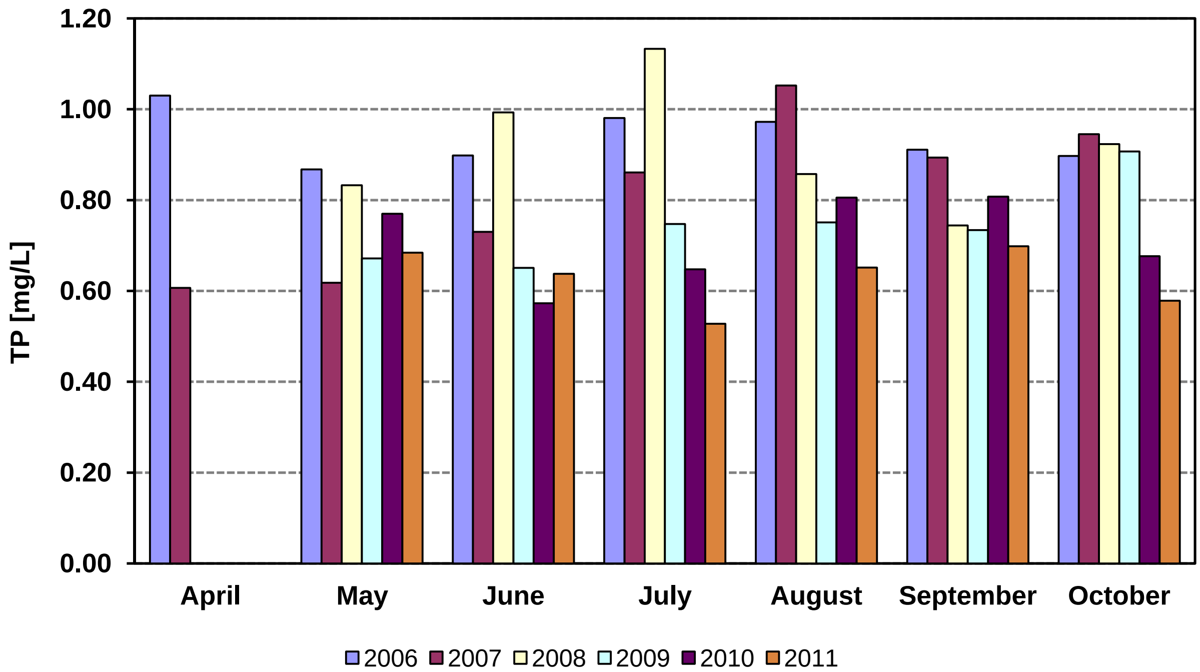

Figure 9-5. Effluent Total Phosphorus Concentrations in April through October (2006-2011)

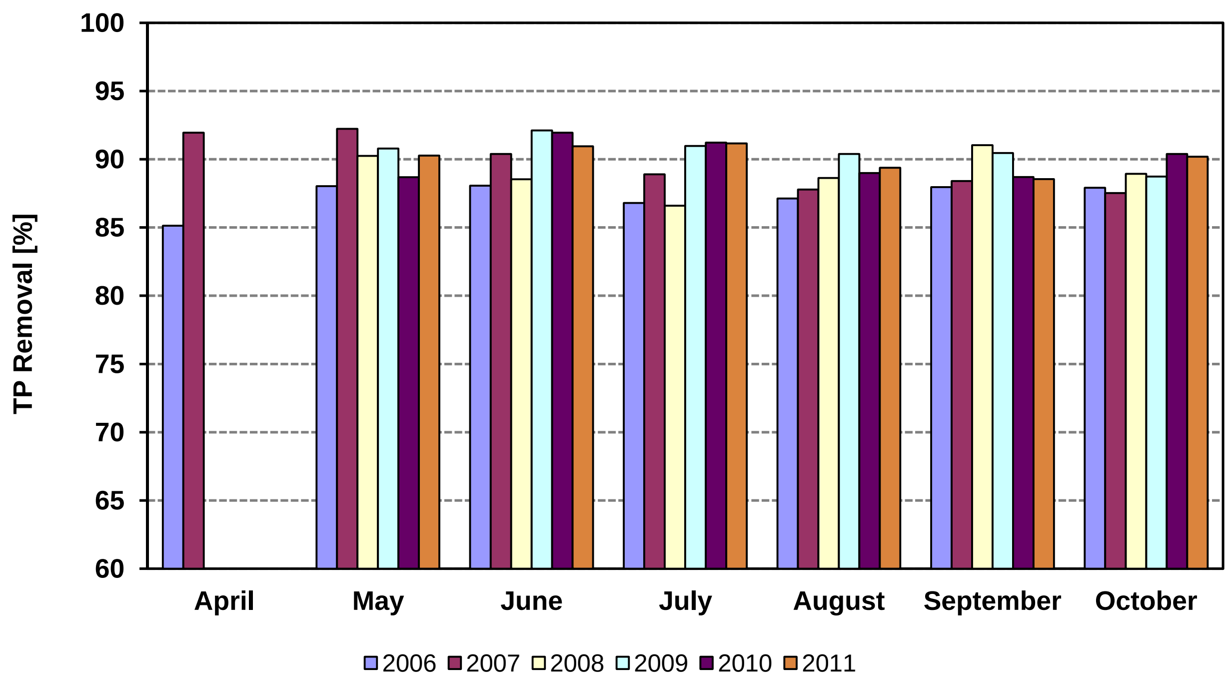

Figure 9-6. Phosphorus Removal Percentage April through October (2006-2011)

9.2.2.5 2009 – 2011 Flow and Loading Trends

For this update to the 2009 Wastewater Facility Plan Amendment, influent flows and loads have been analyzed from July 2008 through October 2011 to reflect changes in trends, which could impact the design of Phase 5C improvements. Information back to 2006 is presented to show an overlap with the previous flow and loading trend analysis in the 2009 Wastewater Facility Plan Amendment.

9.2.2.5.1 Wastewater Treatment Plan Flows and Loads

Wastewater plant flows have remained relatively flat from 2006 through 2011. Plant flows are shown in Figure 9-7. Flow data from January 2006 through June 2008 is presented as monthly average data. Flow data from July 2008 through October 2011 is presented as daily flow and 30-day average flow. In general, the influent wastewater flow and loadings increased from 2000 to 2008 by approximately 11 percent. From 2006 through 2011, the flows increased from 3.43 mgd to 3.49 mgd, an increase of less than two percent.

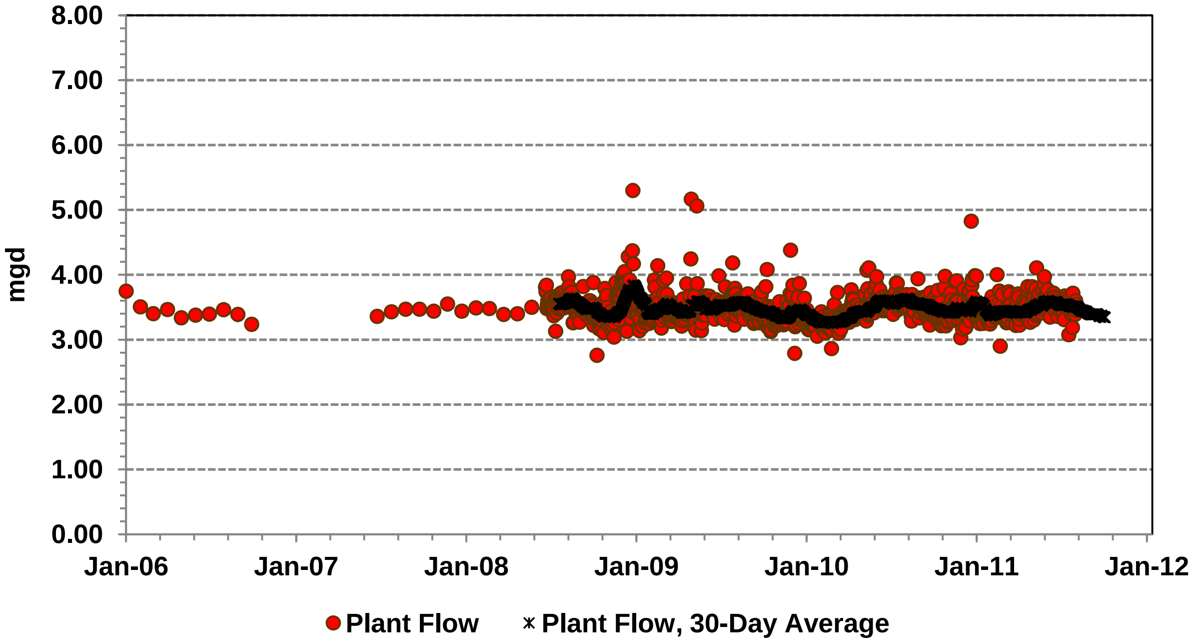

Figure 9-7. Wastewater Flow as measured by the Effluent Flow Meter (January 2006 through October 2011)

The 2000 Wastewater Facility Plan and the 2009 Wastewater Facility Plan Amendment included flow projections based on low-density and medium-density population growth projections for Coeur d'Alene. The actual plant flows (monthly average, effluent flow meter) and the low-density and medium-density flow projections are shown in Figure 9-8. For 2010, the low-density annual average flow projection was 4.52 mgd and the medium-density flow annual average projection was 5.08 mgd. The measured annual average flow for 2010 was 3.45 mgd, 24 percent less than the low-density flow projection and 32 percent less than the medium density flow projection. The annual percent difference between the actual flow and the low density flow projections from the 2000 Wastewater Facility Plan has varied from -7 percent in 2000 to as much as -32 percent in 2010 (Table 9-2).

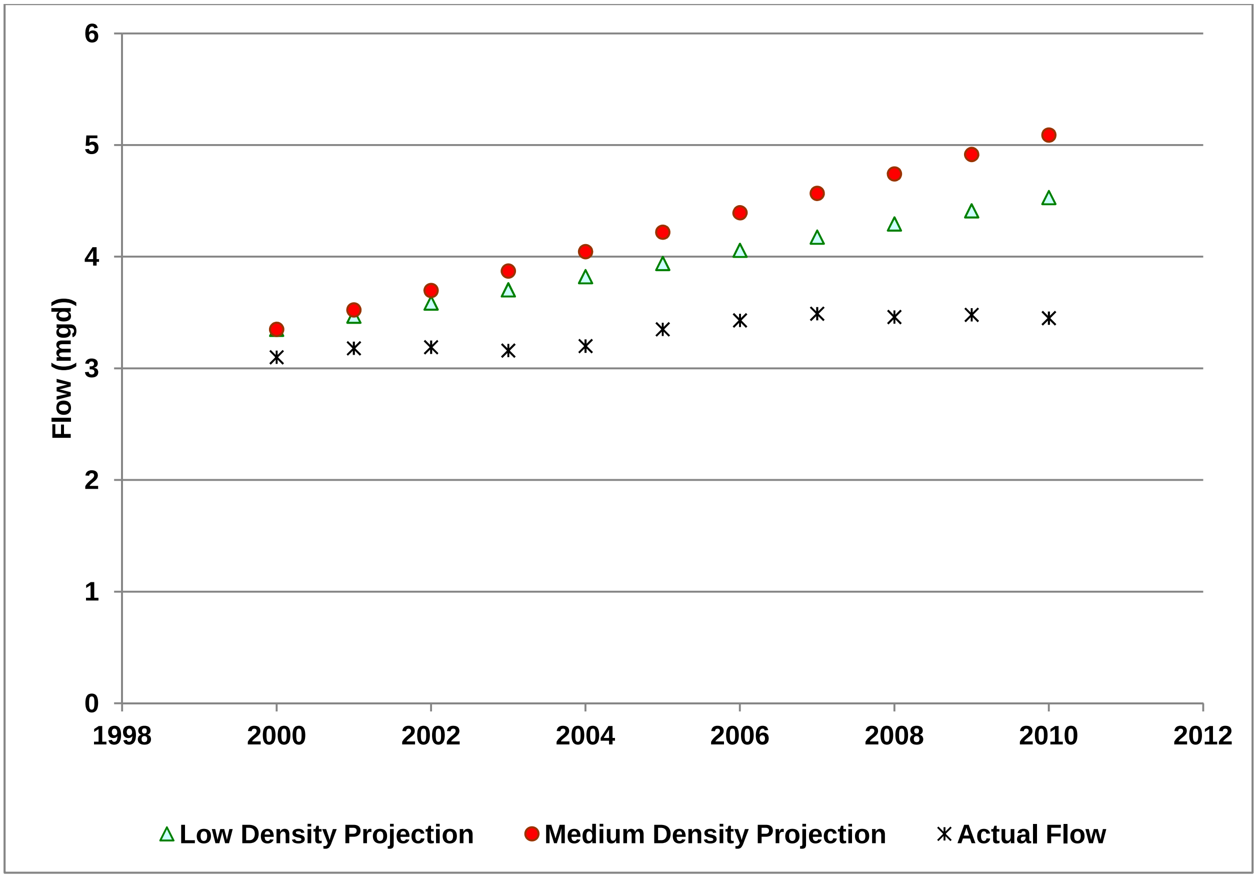

Figure 9-8. Annual Average Wastewater Flows (2000-2010) Compared with Low and Medium Development Density Projected Flows

Table 9-2. Annual Percent Different between Actual Flow and Flow Projections

Year	Low Density	Medium Density
2000	-7%	-7%
2005	-15%	-21%
2010	-24%	-32%

Flow and load projections were completed as part of the 2000 Wastewater Facility Plan. As a part of this update to the 2009 Wastewater Facility Plan Amendment, the flow and load projections were compared to the actual annual average flows and loads for 2000, 2005, and 2010. A summary of the influent flow and load characteristics is presented in Table 9-3.

Table 9-3. Comparison of Projected Flows from 2000 Flows and Loads and Actual Flows and Loads

	2000		2005		2010	
	Projected	**Actual**	***Projected***	**Actual**	***Projected***	**Actual**
Flow (mgd)	*3.35*	3.1	*4.22*	3.35	*5.08*	3.45
BOD (lb/d)	*6,980*	5,070	*8,800*	5,420	*10,590*	7,460
TSS (lb/ d)	*5,340*	5,400	*6,720*	5,790	*8,090*	7,600
Total P (lb/d)	*200*	190	*250*	204	*300*	220
Total NH4-N (lb/ d)	*920*	815	*1,160*	825	*1,400*	990

9.2.2.5.2 Influent Carbonaceous Biochemical Oxygen Demand (CBOD)

The average influent CBOD concentration has increased from 222 mg/L in 2009 to 259 mg/L in 2011 (January through October average), an increase of 16.7 percent. While the increase from 245 mg/L in 2008 to the current average concentration has been relatively low at 5.7 percent, the increase from 196 mg/L in 2000 has been much more substantial at 31.8 percent or almost 2.9 percent per year on average. Figure 9-9 shows the 30-day average influent CBOD load and the influent CBOD concentration, which was calculated based on the influent load and flow data.

Although the influent flow has remained relatively constant in recent years, the influent CBOD loading has increased because of the increasing influent CBOD concentration. The CBOD load has increased from approximately 7,130 lb/d in 2009 to 8,160 lb/d in 2011, an increase of approximately 7.2 percent per year. Overall, the influent CBOD load has increased approximately 5.5 percent per year on average since 2000.

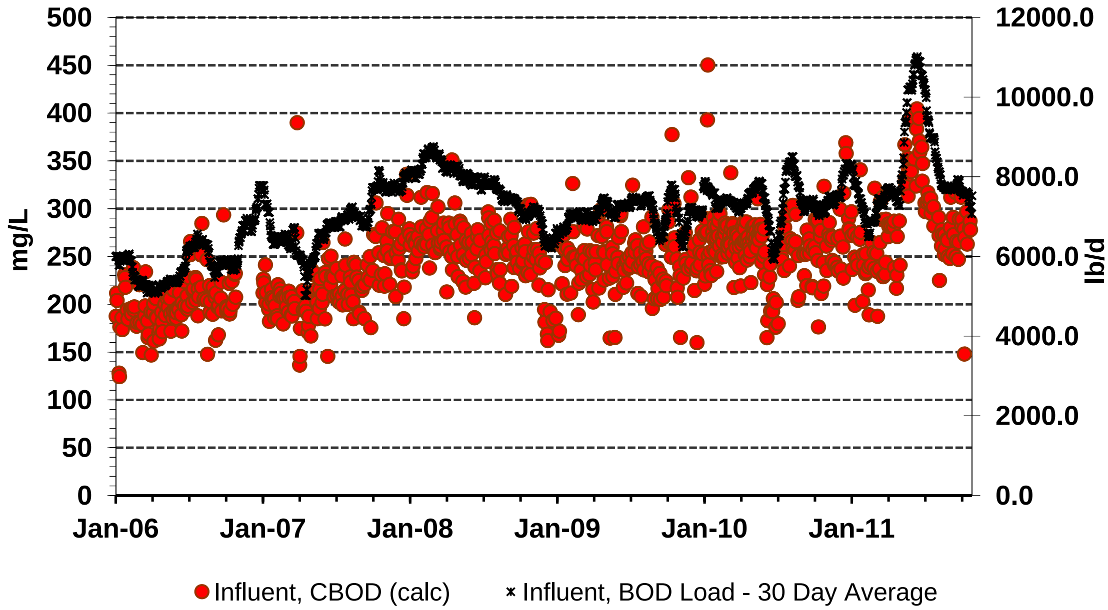

Figure 9-9. Influent CBOD Concentration and 30-day Average Load

9.2.2.5.3 Influent Total Suspended Solids

Influent total suspended solids (TSS) concentrations have been relatively constant over the past ten years, increasing nine percent from 2000 to 2010 as seen in Figure 9-10. Influent flows have also not increased substantially (Figure 9-7); therefore, the influent TSS loading has remained relatively unchanged. This is especially true for the most recent three years where influent concentrations have decreased by seven percent.

On May 8, 2011, the plant staff changed the type and location of influent sampler in an attempt to more accurately reflect influent wastewater characteristics. Following the sampler change, the influent TSS concentrations increased from an average of 239 mg/L (May - August 2009 and 2010) to 334 mg/L (May 8, 2011 - August 31, 2011), an increase of 40 percent (Figure 9-10).

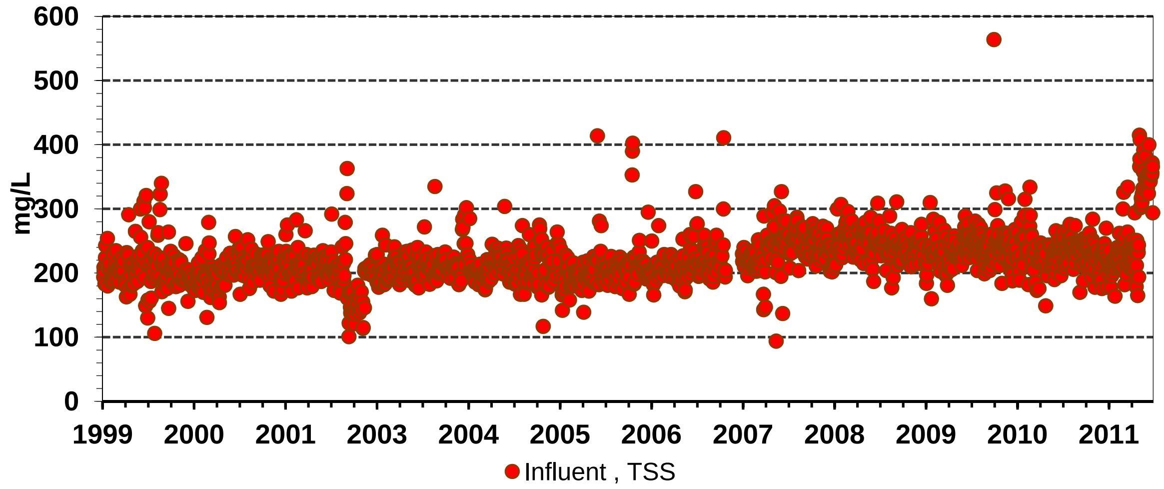

Figure 9-10. Influent Total Suspend Solids Concentration from January 2000 through June 2011

The influent TSS concentration and load are shown in Figure 9-11. The influent TSS load is calculated based on daily values from the effluent flow meter and concentration from 24-hour composite samples. The effluent flow is used for reporting loads on the monthly discharge monitoring reports (DMRs). The data show that the influent TSS load has remained relatively constant over the past three years with the exception of the period of data after the sampler type and location were changed (Figure 9-11).

In order to understand the impact of changing the sampler type and location, the influent TSS concentration prior to, and following the change, were compared to the primary clarifier effluent TSS concentration (Figure 9-12). Wastewater Engineering Treatment and Reuse (Metcalf and Eddy, 2003) and the WEF Manual of Practice 8 – Design of Municipal Wastewater Treatment Plants (2010) indicate that typical primary clarifier TSS removal performance ranges from 50 to 70 percent. The average influent TSS and primary clarifier effluent TSS concentrations from July 1, 2008 through May 7, 2011 were 235 mg/L and 92 mg/L, respectively. The primary clarifier TSS removal performance during this period was 60 percent. This performance is within the typical range. Metcalf and Eddy also includes a figure used to estimate typical TSS removal in primary clarifiers based on influent TSS concentration and detention time. At a detention time of 3.2 hours, the estimated removal is approximately 65 percent for a range of influent TSS concentration of 200 to 300 mg/L.

Since May 8, 2011, the date on which the influent sampling location was changed, to August 31, 2011 the average influent TSS concentration was 334 mg/L and the average primary clarifier effluent TSS concentration was 73 mg/L. This equates to primary clarifier performance of 79 percent TSS removal, well above the typical range. This unusually high primary removal rate may be explained by a number of factors including the change in influent sampling and other discrepancies in monitoring data, such as primary clarifier performance that is based on a 24-hour composite sample for the primary influent TSS and a grab sample for the primary effluent TSS. This may introduce measurement error, which could impact the accuracy of the TSS removal rate calculation for primary sedimentation.

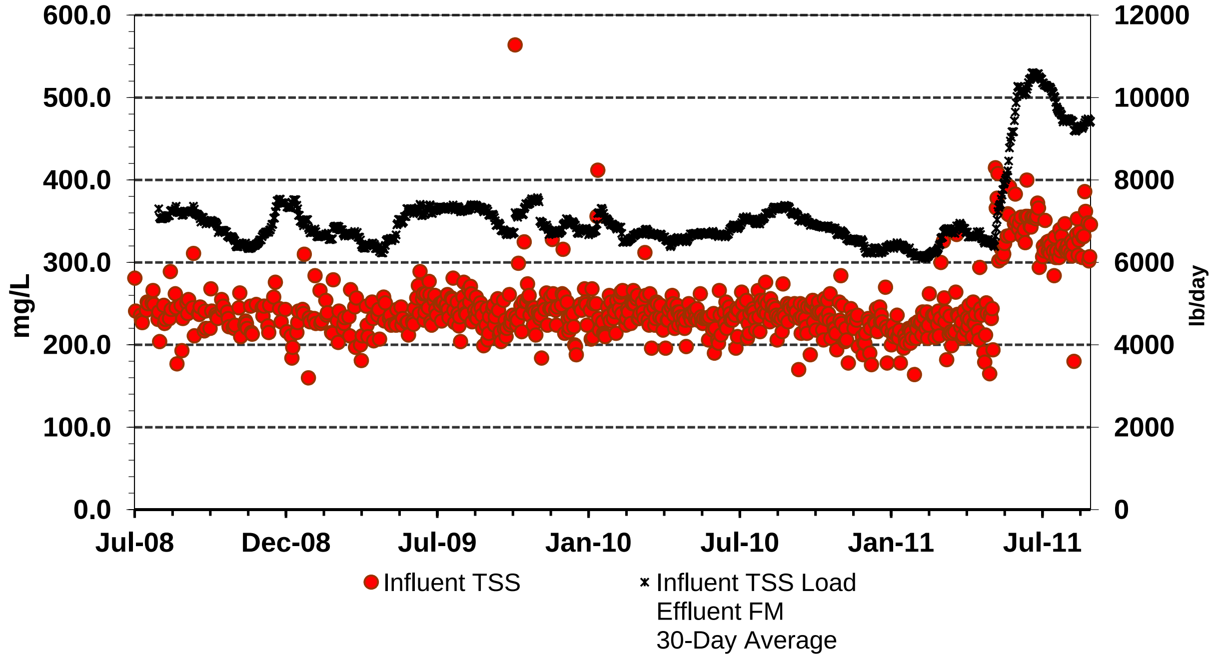

Figure 9-11. Influent TSS Load (Influent Concentration and Effluent Flow) and Concentration

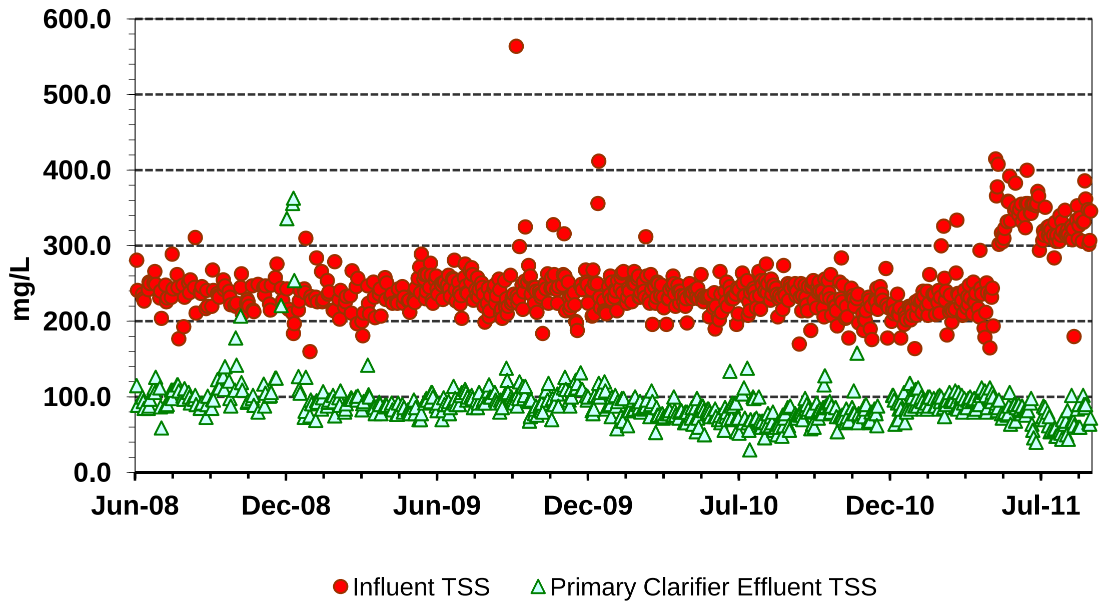

Figure 9-12. Influent TSS and Primary Clarifier Effluent TSS Concentrations

9.2.2.5.4 Influent Ammonia Nitrogen

Influent ammonia nitrogen concentration and 30-day average loads are shown in Figure 9-13. The influent ammonia concentration has remained relatively unchanged and with stable flows over the past three years, the ammonia nitrogen loading has remained constant.

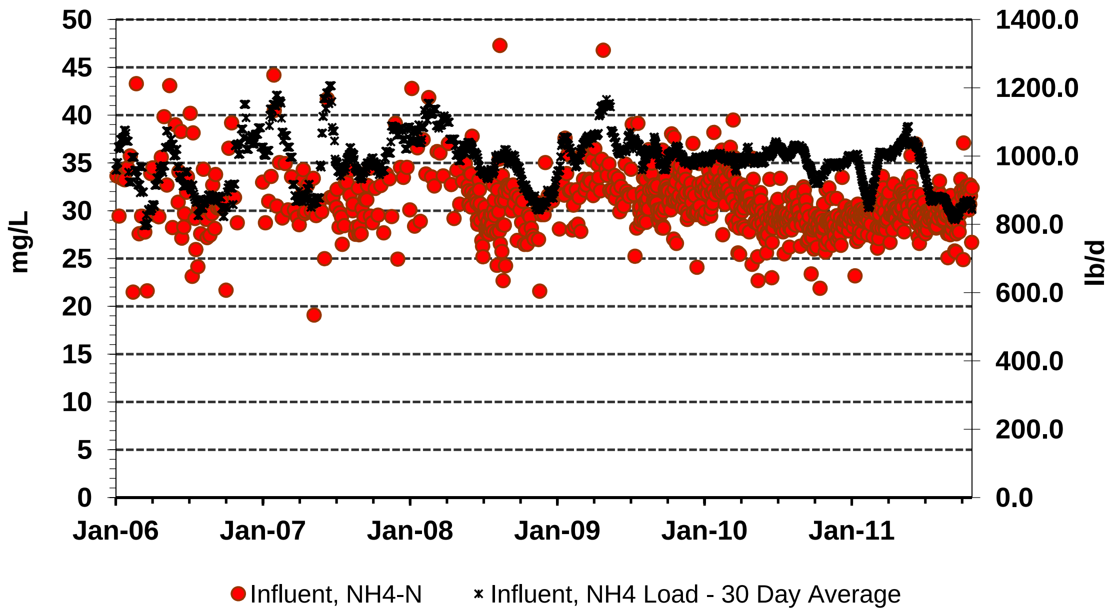

Figure 9-13. Influent Ammonia Nitrogen Concentrations and 30-day Average Load

9.2.2.5.5 Influent Phosphorus

Influent total phosphorus concentrations and 30-day average loads are shown in Figure 9-14. Phosphorus concentrations have decreased from approximately 7.4 mg/L in 2009 to 6.0 mg/L in 2011 (January through October average), a decrease of approximately 19 percent. The recent phosphorus dish washing detergent ban is one plausible explanation for the decrease in influent phosphorus concentrations. Sixteen states, including Washington, Oregon and Montana, passed legislation that eliminated phosphate from dish detergent products effective in July 2010.

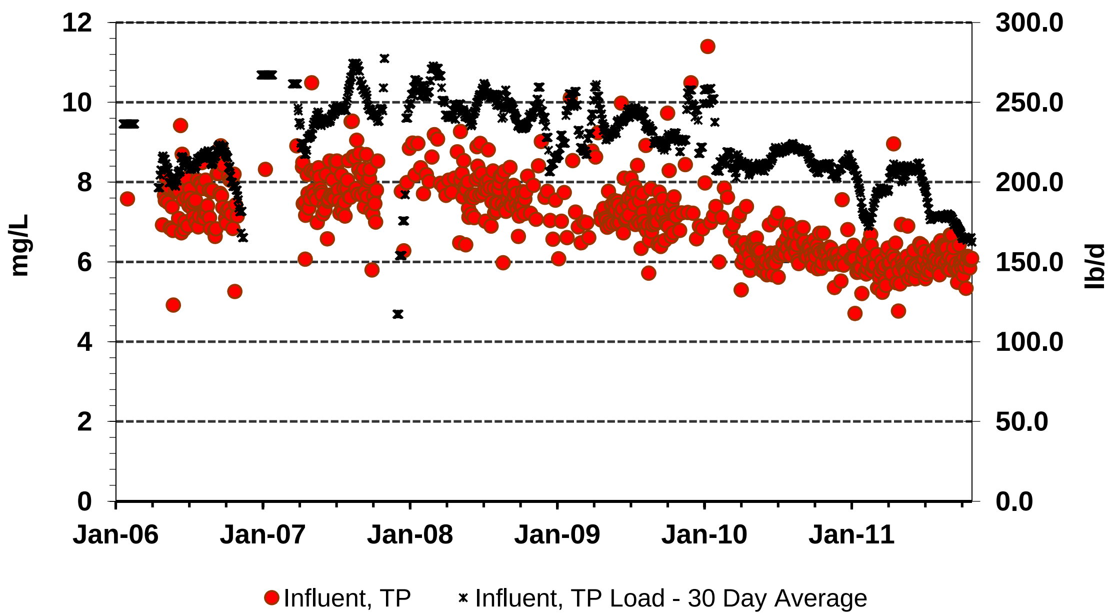

Figure 9-14. Influent Phosphorus Concentrations and 30-day Average Load

9.2.2.5.6 2009 – 2011 Influent Trend Summary

The analysis of influent flow showed that influent flow remained relatively unchanged from 2009 to 2011. The sudden drop in 30-day average influent flow after June 2008 represents a change in the data recording from the influent to effluent flow meter. Overall, the influent flow has increased 22 percent since 2000. The analysis of influent concentrations and loads showed that from 2009 to 2011 CBOD has increased, TSS and ammonia nitrogen have remained relatively unchanged and phosphorus has decreased. From 2006 to 2011, influent CBOD, TSS and ammonia nitrogen loads have all increased, however, phosphorus loads have remained relatively unchanged. Figure 9-15 compares the 30-day average flow trend with 30-day average BOD load and TSS load. Figure 9-16 compares the same flow trend with 30-day average ammonia nitrogen and phosphorus. The fact that the influent flow increases at a lesser rate than loads in thought to be mainly a result of water conservation.

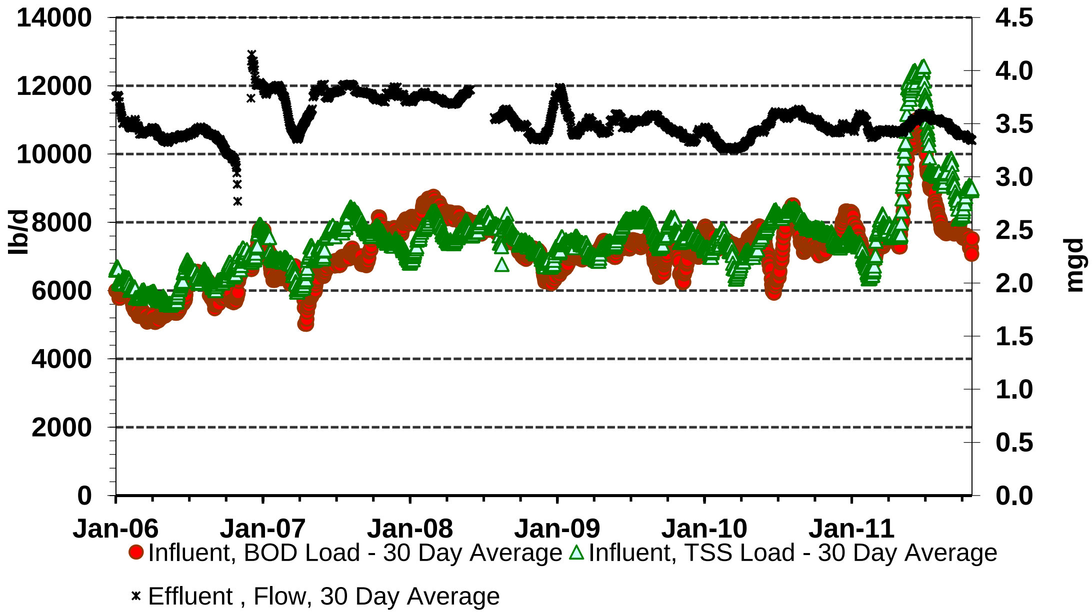

Figure 9-15. 30-day Averages of Influent Flow, Influent BOD and TSS Load

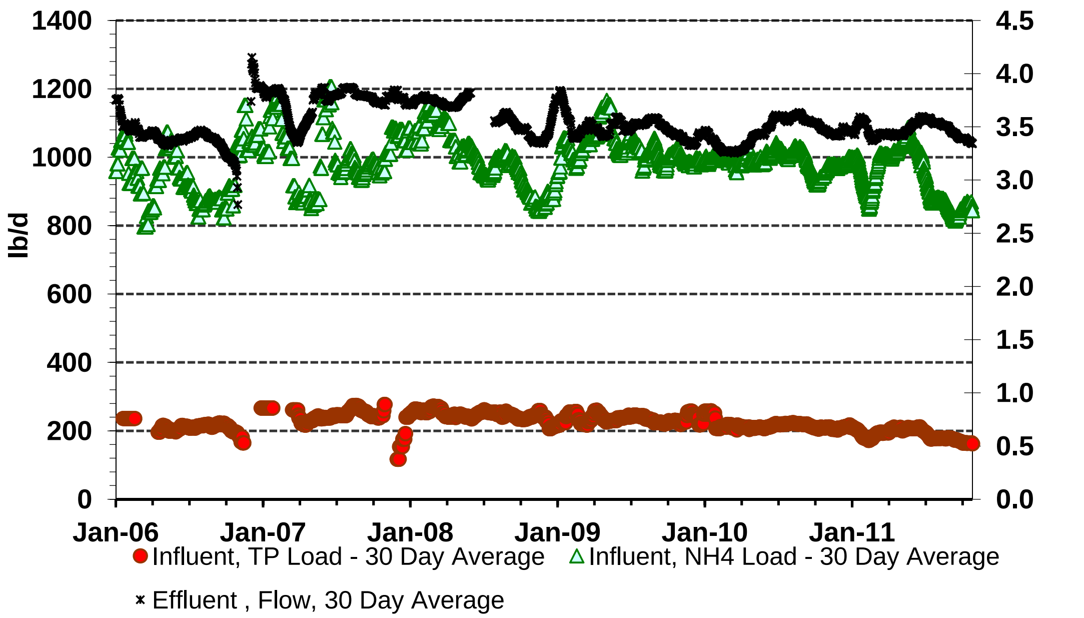

Figure 9-16. 30-day Averages of Influent Flow, Influent Ammonia Nitrogen and Phosphorus

9.3 Regulatory/Permitting Review

9.3.1 Introduction

The City's current National Pollutant Discharge Elimination System (NPDES) permit and pending NPDES permit renewal are the drivers for technology upgrades at the wastewater treatment plant. The U.S. Environmental Protection Agency (EPA) has regulatory authority for issuing City's NPDES permit. The City of Coeur d'Alene discharges to the Spokane River, which flows from Idaho into Washington, and the Spokane River must meet the water quality standards for both the state of Idaho and the state of Washington.

9.3.2 Permit and Regulatory Issue Summary

The key regulatory and permitting issues are summarized in Table 9-6 .Using the same parameters presented in the 2009 Wastewater Facility Plan Amendment, unless otherwise noted. Current treatment plant NPDES permit limits are included in the table, as well as anticipated permit limits, which are based on communications with Idaho DEQ, the Washington Department of Ecology (Ecology), and Region 10 EPA. Additional information about future effluent limits is based on the water quality modeling completed by LimnoTech, Inc. (LTI) to simulate effluent TMDL parameters (CBOD, ammonia nitrogen) for equivalency with the Ecology TMDL and the recently available preliminary draft of the NPDES permit from EPA.

9.3.2.1 NPDES Discharge Permit History

The City of Coeur d'Alene currently operates under the administratively extended 2004 NPDES permit modification. EPA shared what was labeled a "*Preliminary draft. Pre-decisional*" set of proposed effluent limits tables for North Idaho dischargers in February 2010, which made an initial interpretation of how Washington Ecology's Spokane River and Lake Spokane Dissolved Oxygen Total Maximum Daily Load (TMDL) would apply to Idaho NDPES permits. A new NPDES permit for the City of Coeur d'Alene is anticipated to be published in draft form by EPA Region 10 in January 2012. An updated *Preliminary Draft* NPDES permit was obtained by the City of Coeur d'Alene from the Idaho DEQ through a Freedom of Information Act request on November 16, 2011 (Appendix K).

9.3.2.2 Effluent Discharge Permit Development and Schedule

In February 2010, the Spokane River Dissolved Oxygen TMDL was completed by Ecology and approved by EPA later that year (Ecology, 2010). This provided a basis for discharge permit revisions to begin for dischargers to the Spokane River. Additional CE-QUAL-W2 modeling simulations were performed to assess the dissolved oxygen impact associated with a range of phosphorus, ammonia nitrogen, and CBOD discharge concentrations and a modified seasonal limit for phosphorus beginning in February (See Appendix L, LTI technical memoranda).

9.3.2.3 Key Discharge Permit Changes

Significant changes based on the final Spokane River and Lake Spokane Dissolved Oxygen TMDL (Ecology 2010) are anticipated in the new NPDES permit. The effluent total phosphorus, ammonia nitrogen, and carbonaceous BOD limits will be more stringent and will be extended for a longer seasonal period than in the current NPDES permit. New or revised permit limits in the

Preliminary Draft NPDES permit are shown in Table 9-4. Parameters required for reporting only, with no effluent limit, are not included in this summary table.

Table 9-4. New or Revised Final Effluent Limits included in the Preliminary Draft NPDES Permit (2011)

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily
5-day carbonaceous biochemical oxygen demand ($CBOD_5$) *November – January*	mg/L	25	40	-
	lb/d	1251	2002	-
	% removal	85% (min.)		-
$CBOD_5$ *February – March*	mg/L	25	40	
	lb/d	295	472	
	% removal	85% (min.)	-	
$CBOD_5$ *April – October*	mg/L	25	40	
	lb/d	265	424	
	% removal	85% (min.)	-	
E. Coli	#/100 mL	126 (geometric mean)	-	406 (inst. max.)
Total Chlorine Residual *October – June*	µg/L	150	-	390
	lb/d	7.5	-	20
Total Chlorine Residual *July – September*	µg/L	39	-	102
	lb/d	2.0	-	5.1
Total Ammonia as N *March – June*	lb/d	649	-	1547
Total Ammonia as N *July – September*	mg/L	6.59	-	15.7
	lb/d	330	-	786
Total Ammonia as N *October*	lb/d	525	-	1252
Total Ammonia as N *March – October*	lb/d	Seasonal Average 272 lb/d		
Total Phosphorus as P *February – October*	lb/d	Seasonal Average 3.17 lb/d		
Silver *October – June* *Effluent Flow > 4.2 mgd*	µg/L	8.01	-	22.5
	lb/d	0.401	-	1.13
Zinc	µg/L	135	-	168
	lb/d	6.76	-	8.42

In addition to the new or revised effluent limits, the Preliminary Draft NPDES permit includes changes in monitoring and reporting requirements. The compliance schedule included in the Preliminary Draft NPDES permit is shown in Table 9-5.

Table 9-5. Interim Effluent Limits included in the Preliminary Draft NPDES Permit (2011)

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily
Total Ammonia as N *March – June*	mg/L	Report	Report	-
Total Ammonia as N *July – September* *Effluent flow ≤ 4.2 mgd*	mg/L	10	-	29
	lb/d	350	-	1,000
Total Ammonia as N *July – September* *Effluent flow > 4.2 mgd*	mg/L	7.4	-	21
	lb/d	370	-	1,100
Total Phosphorus as P *February – October*	mg/L	1.0	1.6	-
	lb/d	50	80	-

9.3.2.4 Proposed Compliance Schedule

The draft 2007 NPDES permit prepared by Region 10 EPA included a nine-year compliance schedule for new carbonaceous biochemical oxygen demand (CBOD), ammonia nitrogen, and phosphorus limits, with interim limits for CBOD and phosphorus. Also included was a complex structure with multiple milestones that requires the City to report on progress made in accomplishing interim steps toward full compliance. The Preliminary Draft NPDES permit includes a comment, which states, "*The details of the compliance schedule and interim requirements will be based on the State of Idaho's draft Clean Water Act section 401 certification.*" The 2007 draft permit included the following milestones, which are included in this facility plan update as an example of what is anticipated in the NPDES permit:

- Submit an engineering report to EPA and DEQ one year after the effective date of the permit outlining the estimated costs and schedules for completing capacity expansion and implementation of technologies to meet the final effluent limitations.
- Provide written notice to EPA and DEQ that pilot testing of the technology that will be employed to achieve final limits has been completed and submit a summary report on results and plans for implementation within four years of the effective date of the permit.
- Provide EPA and DEQ written notice that design has been completed and bids awarded to begin construction of facilities to meet final effluent limitations by the expiration date of the final permit.
- Provide EPA and DEQ written notice that construction has been completed on facilities to meet final effluent limitations within seven years of the effective date of the permit.

- Complete start-up, optimization, and achieve compliance with final effluent limitations by within 9 years of the effective date of the permit.
- Provide EPA and DEQ written reports which outline the progress made toward achieving compliance with the phosphorus, ammonia nitrogen and CBOD effluent limitations by two, three, six and eight years after the effective date of the permit. Reports must include the following, at a minimum:
    - Assessment of the previous year of effluent data and comparison to the effluent limitations.
    - A report on progress made toward meeting the effluent limitations.
    - A report on progress made toward completing remaining interim requirements of the compliance schedule.
    - Further actions and milestones targeted for the next year.

9.3.3 2010 Dissolved Oxygen TMDL and NPDES Discharge Permit Update

The final Spokane River Dissolved Oxygen TMDL included updates to the water quality modeling presented in earlier drafts. This TMDL set the total phosphorus, ammonia nitrogen, and CBOD wasteload allocations for Washington dischargers. The wasteload allocations are based on the selected TMDL loading scenario used for water quality modeling, which included the Idaho discharges. Equivalent alternative loading scenarios were then developed by the dischargers and used for negotiations with EPA in anticipation that these scenarios will be used for drafting the NPDES permits.

Table 9-6: Summary of Anticipated Regulatory and Permitting Issues

Regulatory Issue/Parameter	NPDES Permit Limitations and Issues	NPDES Permit Limits[1]	Importance to Planning
Effluent Discharge			
Flow	The Final 2010 Dissolved Oxygen TMDL for the Spokane River is based on the projected future flow of 7.6 mgd. The calculations for chronic and acute toxicity concentrations for ammonia nitrogen are based on 6 mgd.	Y	High
BOD	The May 2011 LTI modeling used to demonstrate equivalency with the TMDL scenario by optimizing the combination of TMDL parameters (BOD, TP, NH_3-N) is based on a CBOD discharge of 295 lb/d monthly average and 472 lb/day weekly average February-March, and discharge of 265 lb/d monthly average and 424 lb/d weekly average April-October. The Preliminary Draft NPDES permit[2] is structured with a seasonal mass limit for the TMDL parameters (CBOD, TP, and NH_3-N). The equivalent concentrations that were modeled by LTI were used to calculate the allowable seasonal mass load.	C (concentration for compliance with treatment technology based limits only and unnecessary for TMDL compliance),M (seasonal mass loading limits for TMDL compliance)	High
TSS	Secondary treatment standards continue (Average monthly: 30 mg/l, 1,501 lb/d and 85% removal. Average weekly: 45 mg/l and 2,252 lb/d).	C,M	Moderate
Phosphorus	The May 2011 LTI modeling used to demonstrate equivalency with the TMDL scenario by optimizing the combination of TMDL parameters (BOD, TP, NH_3-N) includes a phosphorus limit of 3.17 lb/d beginning in February and continuing through October. The Preliminary Draft NPDES permit[2] is structured with a seasonal mass limit for the TMDL parameters (CBOD, TP, and NH_4-N). The equivalent concentrations that were modeled by LTI were used to calculate the allowable seasonal mass load.	C,M (for interim limits),R	High
Ammonia Nitrogen	The May 2011 LTI modeling used to demonstrate equivalency with the TMDL scenario by optimizing the combination of TMDL parameters (BOD, TP, NH_3-N) is based on an ammonia nitrogen discharge of 272 lb/d from March-October. The Preliminary Draft NPDES permit[2] is structured with a seasonal mass limit for the TMDL parameters (CBOD, TP, and NH_3-N). It is critical that the TMDL limits be stated in the NPDES permit as seasonal mass loadings because the cooler wastewater temperatures in the spring will	C (only for control of nearfield toxicity),M (season mass loading over the TMDL season)	High

Table 9-6: Summary of Anticipated Regulatory and Permitting Issues

Regulatory Issue/Parameter	NPDES Permit Limitations and Issues	NPDES Permit Limits[1]	Importance to Planning
	inhibit nitrification due to slower treatment process kinetics. The equivalent concentrations that were modeled by LTI were used to calculate the allowable seasonal mass load. The Preliminary Draft NPDES permit also includes average monthly and maximum daily concentration limits based on preventing toxicity. These concentrations are well above the TMDL seasonal mass loading limits. (Future issues: Effluent ammonia nitrogen concentration limits could be lower in the future than the limits included in the Preliminary Draft NPDES permit. See ammonia nitrogen, below.)		
Total Nitrogen	No current limitations. Idaho DEQ pursuing "preventative TMDL" for Spokane River. (Future issues: Water quality studies indicating nitrogen limitation requirements. Not currently considered probable.)	N	High
Chlorine Residual	The Preliminary Draft NPDES permit[2] identified total residual chlorine limits for July -September (Average monthly: 39 µg/l and 2 lb/d. Maximum daily 102 µg/l and 5.1 lb/d) and October to June (Average monthly: 150 µg/l and 7.5 lb/d. Maximum daily 390 µg/l and 20 lb/d). The average monthly limits for July – October are not quantifiable using EPA-approved methods. Permittee is considered compliant if monthly average is 100 µg/l and the average loading is less than 5 lb/d.	C,M	Moderate
Bacteria	It is anticipated that the NPDES permit will include E. Coli limits based on the 2011 Idaho Water Quality Standards. (Average monthly: 126 cfu/100 mL. Maximum instantaneous: 406 cfu/100 mL).	C	Moderate
Metals	The City's current NPDES permit includes limits for copper, lead, silver, and zinc as well as monitoring requirements for cadmium. Based on the NPDES permits for other Spokane River dischargers, it is possible that the City will receive cadmium limits in their future permit and will be required to complete additional metals monitoring.	C,M,R Y	High
Silver	The Preliminary Draft NPDES permit[2] identifies effluent limits for total recoverable silver for October – June (Average monthly: 8.01 µg/l and 0.401 lb/d. Maximum daily: 22.5 µg/l and 1.13 lb/d)	C,M	Moderate
Zinc	The Preliminary Draft NDPES permit[2] identifies effluent limits for total recoverable zinc (Average monthly: 135 µg/l and 6.76 lb/d. Maximum daily: 168 µg/l and 8.42 lb/d).	C,M	Moderate

Table 9-6: Summary of Anticipated Regulatory and Permitting Issues

Regulatory Issue/Parameter	NPDES Permit Limitations and Issues	NPDES Permit Limits[1]	Importance to Planning
Biomonitoring	Whole effluent toxicity testing required semi-annually.	Y	Low
Biosolids (Wastewater Treatment Plant – Class B)	Biosolids management must meet 40 CRF 503 Subparts A, B and D. The Preliminary Draft NDPES Permit Fact Sheet[2] states that EPA Region 10 may issue a sludge-only permit to a facility at a later date.	S	Moderate
Biosolids (Composting Facility – Class A)	Until issuance of a sludge-only permit, sludge management activities continue to be subject to the national standards and any requirements of the State's biosolids program.	S	Moderate
Pretreatment Requirements	The City must sustain its Industrial Pretreatment Program. Pretreatment reports must be submitted annually. The Preliminary Draft NPDES permit[2] calls for a Local Limits Evaluation to be conducted and submitted to EPA within 1 year of the effective date of the permit.	Y	High
Total Polychlorinated Biphenyls (PCB's) and 2,3,4,8 tetrachloro-dibenzo-p-dioxin (TCDD)	No current limitations. However, the Preliminary Draft NPDES permit[2] includes extensive monitoring requirements and preparation of a Toxics Management Plan within 180 days of the effective date of the final permit. (Future issues: PCB's and 2,3,4,8 TCDD could be included in future NPDES permits.)	Monitoring Toxics Management Plan	High
Operations and Maintenance	The Preliminary Draft NPDES permit[2] calls for an Operations and Maintenance Plan to be developed and implemented, with written notice to EPA, within 180 days of the effective date of the permit.	Y	Low
Temperature	No current discharge permit limitations on temperature. Monitoring of temperature is required. (Future issues: Potential for future Endangered Species Act considerations to increase scrutiny of receiving water conditions related to temperature.)	N	Moderate
Virus Control	May have stricter requirements in the future as analytical methods improve.	N	Moderate
Infiltration/Inflow	Inflow reduction targets pursued in Comprehensive Sewer Plan to control peak flows. Inflow to the sewer system drives peak flows at the treatment plant and stresses peak capacity of unit processes. Inflow removal drives infrastructure needs for stormwater management.	N	High

Table 9-6: Summary of Anticipated Regulatory and Permitting Issues

Regulatory Issue/Parameter	NPDES Permit Limitations and Issues	NPDES Permit Limits[1]	Importance to Planning
Air Emissions			
Air Toxics	Regulations apply to VOCs, H_2S, Cl_2; but not likely to be considered major sources. Clean Air Act Section 112r Risk Management Plan (RMP) requirements had a compliance deadline of June 21, 1999.	N N	Low High
Odor Control	Maintenance of good neighbor policy has high priority. Odor containment and treatment facilities commissioned in 1999. No specific regulatory requirements apply; subject to local standards.	N	High
Visual Appearance	Maintenance of good neighbor policy has high priority. No specific regulatory requirements apply; subject to local standards. Defacto neighborhood standards may dictate acceptable architectural appearance.	N	High
Noise Control	Maintenance of good neighbor policy has high priority. No specific regulatory requirements apply; subject to local standards.	N	Low
Endangered Species			
ESA Listings	U.S Fish and Wildlife Service identified the threatened species (Canada lynx, bull trout, water howellia, and Spalding's catchfly) and proposed designated habitat (bull trout) in Kootenai County. The National Marine Fisheries Service stated that there are no threatened or endangered species under its jurisdiction in the Spokane River; however several species of salmonids listed as endangered are present downstream in the Columbia River. EPA determined that the 1999 NPDES permit would not impact bull trout.	N	Low
Bull Trout	Bull trout identified as "threatened species" in July 2009 listing. U.S Fish and Wildlife Service have indicated that bull trout cannot pass Post Falls dam and those present in the Spokane River may be transient from Lake Coeur d'Alene. For bull trout spawning and juvenile rearing, EPA has developed standards for Idaho (10 degree C; June, July, August, September; specific locations.) Idaho DEQ developing bull trout criteria. (Future issues: Potential for increased scrutiny of water quality criteria in consideration of ESA listings.)	N	Moderate
Groundwater Protection	Continue to extend sewer service and limit construction of new septic systems to one per five acres. Limited septage, non-domestic pumpable	N	High

Table 9-6: Summary of Anticipated Regulatory and Permitting Issues

Regulatory Issue/Parameter	NPDES Permit Limitations and Issues	NPDES Permit Limits[1]	Importance to Planning
	sludge disposal sites may drive loadings to wastewater treatment plant.		
Recycled Water	Idaho DEQ 2011 Recycled Water Rules and permits are required. Recycled water may be a management tool for load diversion from the Spokane River.	Idaho DEQ Recycled Water Rules	High
Stormwater	EPA Phase II Stormwater Permitting program has designations for small urban areas with populations of 10,000 or more and includes the City of Coeur d'Alene. Regulated small municipal separate storm sewer systems have permits required by May 31, 2002 and are required to have programs developed and implemented by 2007. Stormwater loadings to the Spokane River consume shared assimilative capacity. Inflow reduction efforts to reduce peak wastewater loadings could increase stormwater loadings and infrastructure requirements.	(Stormwater NPDES permit required for Coeur d'Alene)	High

[1] November 2, 1999 NPDES discharge permit, coded as follows:

[2] A preliminary draft NPDES discharge permit was shared with the City of Coeur d'Alene in November 2011. Information from that permit was reviewed and included in this summary table.

Y, Yes included

N, No, not included

C, Concentration Limit

M, Mass Limit

S, Supplementary Condition

R, Potential Re-Opener Clause

Yellow Highlighted – updates to the Facility Plan Amendment

In addition to the parameters described above, the Preliminary Draft NPDES permit requires monitoring and reporting for a number of additional parameters, as shown in Table 9-7 Perhaps the most important new additions are total polychlorinated biphenols (PCBs) and 2,3,7,8 tetrachloro-dibenzo-p-dioxin (TCDD) linked to Ecology's PCB assessment of the Spokane River. Although PCB production has been long been banned, legacy sources and impurities in current commercial products result in continuing amounts of PCBs reaching waterways.

The Ecology PCB assessment is driven by a new Spokane Tribe human health water quality criterion for total PCBs of 3.37 picograms per liter (pg/l). The new water quality standard adopted by the Spokane Tribe is based on human health risks associated with higher fish consumption rates than historically included in the National Toxics Rule and is a very low concentration compared to ambient concentrations in the river and potential sources, such as stormwater and wastewater discharges. Ecology proposed a PCB loading scenario to meet the new Spokane Tribe standard that would require a 95 percent PCB load reduction at the Idaho border, a 97 percent load reduction in the Little Spokane River, and more than 99 percent reductions in municipal, industrial, and stormwater discharges.

The City will be required to prepare a Toxics Management Plan and dischargers are planning for this approach to satisfy water quality requirements for PCBs. Beyond the near term impact on the City of the increased laboratory analytical costs for PCBs at low detection limits, the long term concern is whether compliance with such a low water quality standard is attainable.

Table 9-7. Effluent Water Quality Parameters to be Monitored and Reported

Regulatory Issue/Parameter	Importance to Planning
Cadmium	Moderate
Copper	Low
Lead	Moderate
Temperature	Moderate
Alkalinity	Low
Hardness	Moderate
Oil and Grease	Moderate
Total Dissolved Solids	Low
Total Polychlorinated Biphenols (PCBs)	High
2,3,7,8 tetrachloro-dibenzo-p-dioxin (TCDD)	High
Orthophosphate as P	High
Total Kjeldahl Nitrogen	Moderate
Nitrate-Nitrite as N	Moderate
Dissolved Oxygen	Moderate

9.3.3.1 Plant Effluent and Spokane River Flows

Statistical flow values (i.e., flow values based on the probability of occurrence in the Spokane River) were not used for setting permit limits because the Spokane River is regulated by Post Falls Dam. The critical flow, as set in the Federal Energy Regulatory Commission (FERC) license for the minimum release requirement from Post Falls dam is 600 cubic feet per second (cfs) from June 7th until the Tuesday following Labor Day. The minimum flow is reduced to 500 cfs if the lake level falls below 2,127.5 feet during the summer (FERC License for Projects 2545-091 and 12606-000, June 2009). After discussions between EPA and DEQ, this flow was selected for the ammonia nitrogen discharge limit calculations.

9.3.3.2 Biochemical Oxygen Demand

The Spokane River TMDL includes a wasteload allocation for CBOD for point source dischargers. The most recent LTI modeling (May 2011) used to demonstrate equivalency with the TMDL scenario is based on a February through March CBOD discharge of 3.56 mg/L and an April through October discharge of 3.2 mg/L. It is important to note that it is advantageous for the CBOD discharge permit limits associated with the TMDL to be expressed as seasonal mass limits, and not monthly or weekly concentrations limits, because the City will have greater flexibility for compliance with mass limits averaged over a long time period.

9.3.3.3 Phosphorus

The Spokane River TMDL includes a wasteload allocation for total phosphorus for point source dischargers. The most recent LTI modeling (May 2011), used to demonstrate equivalency with the TMDL scenario, is based on a February through October phosphorus discharge of 0.050 mg/L. It is important to note that it is advantageous for the phosphorus discharge permit limits to be expressed as seasonal mass limits, and not monthly or weekly concentration limits because the City will have greater flexibility for compliance with mass limits averaged over a long time period.

9.3.3.3.1 Phosphorus Management Plan

The City's Phosphorus Management Plan has not changed since the 2009 Wastewater Facility Plan Amendment.

9.3.3.4 Ammonia Nitrogen

Ammonia nitrogen limits for Coeur d'Alene have evolved over the past 20 years as regulatory criteria have been re-evaluated and revised. There are two different drivers for continued ammonia nitrogen control on the Spokane River: state water quality standards for ammonia based on prevention of toxicity and the dissolved oxygen TMDL for Lake Spokane as ammonia nitrogen is an oxygen-demanding compound. The combination of these requirements will limit effluent ammonia nitrogen discharges from the City in the future with short-term concentration limits to prevent toxicity and mass discharge limitations for compliance with the dissolved oxygen TMDL.

Ammonia nitrogen was added to the City's NPDES permit in 1990 as an effluent mass limit. Since that time, the City has been operating the trickling filter/solids contact (TF/SC) process to reduce ammonia nitrogen at a de-rated plant capacity of approximately 4.2 mgd. The Spokane River TMDL includes a wasteload allocation for ammonia nitrogen for point source dischargers. The most recent LTI modeling (May 2011), used to demonstrate equivalency with the TMDL scenario, is based on a March through October ammonia nitrogen discharge concentration of 4.29 mg/L. It is important to note that the discharge permit limits for ammonia nitrogen associated with the dissolved oxygen TMDL should be expressed as seasonal mass loadings, and not monthly or weekly concentration limits, because this will provide the City with greater flexibility for compliance, especially in the spring when wastewater temperatures are the lowest and nitrification kinetics are slow. Concentration limits will be included in the permit to prevent toxicity, but these concentrations are expected to be higher than the levels associated with the dissolved oxygen TMDL.

9.3.3.5 Revised Federal Toxicity Criteria for Ammonia Nitrogen

EPA published water quality criteria for ammonia nitrogen based on prevention of toxicity to aquatic life. The evolving revised federal ammonia nitrogen criteria, discussed below, will likely drive revisions to the state water quality standards that may reduce future effluent limits in the future.

The 1999 Update of Water Quality Criteria for ammonia nitrogen contains EPA's most recent freshwater aquatic life criteria and is the basis for current water quality standards in Idaho. However, EPA has continued to re-evaluate the current aquatic life criteria for ammonia nitrogen in response to recent ammonia nitrogen toxicity studies across the United States. These studies suggest that some freshwater mussel and snail species may be more sensitive to ammonia nitrogen exposure than the aquatic organisms EPA considered in deriving the current ammonia nitrogen criteria.

EPA developed an update to the aquatic life ambient water quality criteria for ammonia nitrogen in 2009 based on these more sensitive aquatic species, specifically freshwater mussels. This update established acute and chronic ammonia nitrogen criteria for water bodies, with and without mussels present, that are more restrictive compared to the 1999 criteria. Recently, further studies on ammonia nitrogen impacts to snail species led to a revision to the 2009 federal ammonia nitrogen criteria. Based on communication with EPA, the proposed ammonia nitrogen criteria will include an acute and chronic criteria value for the most sensitive species and these criteria will apply to all water bodies. This revision is expected to remove the bifurcated criteria for surface waters with and without mussel species as originally published by EPA in 2009. The revised 2009 federal ammonia nitrogen criteria are currently being reviewed within EPA. In the meantime, EPA’s draft 2009 ammonia nitrogen criteria, with mussels present, may be used as reference for the potential final EPA criteria that is expected to be published in the spring of 2012. A summary of the criteria at a normalized pH and temperature are shown in Table 9-8.

Table 9-8. Draft Federal Ammonia Criteria (EPA 2009)

Condition	Draft 2009 Ammonia Criteria (pH=8, 25°C)	Current 1999 Criteria (pH=8, 25°C)
Acute	2.9 mg/L N	5.6 mg/L N (Salmon present)
Chronic	0.26 mg/L N	1.2 mg/L N(early life stages of fish present)

The impact of the revised criteria on point source dischargers, including the City of Coeur d’Alene, could be significant. State rulemaking is required before the revised federal ammonia criteria are adopted into state water quality standards. It is anticipated that these criteria will be incorporated into the basis for future NPDES permits and result in lower endpoints for toxicity based effluent limits for ammonia.

9.3.3.6 Bacteria and Chlorine Residual

The Water Quality Standards in Idaho were updated in 2011with limits for *E. coli* bacteria as the indicator for human pathogens. The monthly average geometric mean is 126 coliform forming units per 100 milliliters (cfu/100 mL) based on five samples taken every three to seven days over 30 days. The single sample maximum limit is 406 cfu/100 mL.

9.3.3.7 Metals

The City of Coeur d'Alene's current NPDES permit includes monthly average and daily maximum effluent limits for silver and zinc. The City is also required to monitor monthly for copper, lead, and cadmium. The final and draft permits for the City of Spokane and Spokane County (Washington dischargers to the Spokane River), respectively, have permit limits for cadmium, lead and zinc and the dischargers are required to monitor for arsenic, cadmium, copper, lead, zinc, mercury, and silver. Based on the NPDES permits for other Spokane River dischargers, Coeur d'Alene may anticipate cadmium limits and a requirement for additional metals monitoring.

9.3.4 Surface Water Quality Standards – Beneficial Uses

When DEQ updated Idaho's Surface Water Quality Standards in 2011, the beneficial use designations for the Spokane River remain unchanged. The designated beneficial uses for this reach of the river are:

- Agricultural water supply (all waters of the state)
- Cold water communities
- Salmonid spawning
- Primary contact recreation
- Domestic water supply

9.3.5 Surface Water Quality Standards – Criteria

9.3.5.1.1 Antidegradation

The State of Idaho's antidegradation policy is in IDAPA[1] 58.01.12 Section 051 and was updated in March 2011. An implementation section has been added to the Water Quality Standards – IDAPA 58.01.12 Section 052. The implementation section provides information related to required actions for projects and activities that could impact water quality. According to the Water Quality Standards, a constituent's effect on water quality will "be based on the calculated change in concentration in the receiving water as a result of a new or reissued permit or license." All water bodies in Idaho are identified as Tier I, which means the existing uses must be protected and maintained and the numeric water quality criteria must be met. Tier II waters maintain and protect high quality waters and have conditions that are "better than necessary" to support the fishable and swimmable uses. The State of Idaho is currently developing an

[1] Note that the numbering of the Idaho Water Quality Standards has changed. Any reference in the 2009 Wastewater Facility Plan Amendment to IDAPA 16 Title 1 has been changed per State of Idaho regulations to IDAPA 16 Title 58 (as referenced in this update). The Chapter and Section numbers in the rules have remained unchanged.

Antidegradation Guidance (First Draft, 12/10/10) that identifies Tier I and Tier II waters. Tier II waters will be designated based on the following (First Draft Antidegradation Guidance, 2010):

- The water body's category of use according to the most recent federally approved Integrated Report (IR);
- The beneficial use of the receiving water body; and
- Whether data indicate that the water body as a whole is of high quality.

The City of Coeur d'Alene wastewater facility discharges to Spokane River which is listed as Tier I for aquatic life and case- by-case for contact recreation in the Idaho Antidegredation Implementation Procedure Public Comment Draft (August 5, 2011). At the time of a permit renewal, DEQ will evaluate whether there will be increased loads or concentrations of the pollutants identified in the implementation procedures (cadmium, lead, zinc, and total phosphorus for Coeur d'Alene). If no increase is anticipated, the Tier I evaluation is complete and DEQ will provide public notice of this determination.

The sections of the antidegradation policy that were included in the 2009 Wastewater Facility Plan Amendment that have been updated are:

> *"Where the quality of the waters exceeds levels necessary to support propagation of fish, shellfish and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the Department finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the Department's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the Department shall assure water quality adequate to protect existing uses fully. Further, the Department shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and cost-effective and reasonable best management practices for nonpoint source control. In providing such assurance, the Department may enter together into an agreement with other state of Idaho or federal agencies in accordance with Sections 67-2326 through 67-2333, Idaho Code."*

9.3.5.1.2 Mixing Zones

The State Mixing Zone Policy, IDAPA 58 Title 1, Chapter 2, Section 060 describes chronic and acute water quality criteria within the mixing zone. The EPA *Water Quality Standards Handbook, Second Edition*, also describes mixing zones.

- The area or volume of an individual zone or group of zones must be limited to an area or volume as small as practicable that will not interfere with the designated uses or with the established community of aquatic life in the segment for which the uses are designated
- The criterion maximum concentration (CMC) should be met within 10 percent of the distance from the edge of the outfall structure to the edge of the regulatory mixing zone in any spatial direction. Criteria Water Quality Criteria are described in IDAPA 58, Title 1, Chapter 2. Fecal coliform has been replaced with *E. coli* bacteria as shown in Table 9-9.

The interpretation by EPA Region 10 of how mixing zones are established impacts the anticipated mixing zone that will be included in the City's NPDES permit. Based on communication with EPA, the permit writer used a 2.5 percent acute mixing zone to establish the ammonia toxicity limits because acute toxicity controls the anticipated effluent limits, not chronic conditions.

Table 9-9. Updates to Water Quality Criteria in Idaho

Beneficial Use	Regulated Parameter	Water Quality Criteria
General Criteria	*pH*	6.5 to 9.0
Primary Contact Recreation (May 1 – September 30)	*E. coli* bacteria	406/100mL at any time or 236/100 mL at any time for designated beaches 126/100 mL (geometric mean based on 5 samples every 3 to 7 days from a 30 day period
Secondary Contact Recreation	*E. coli* bacteria	576/100 mL at any time 126/100 mL (geometric mean based on 5 samples every 3 to 7 days from a 30 day period

9.3.5.1.3 Metals Total Maximum Daily Load for the Coeur d'Alene River Basin

The TMDL for Dissolved Cadmium, Dissolved Lead, and Dissolved Zinc in Surface Waters of the Coeur d'Alene River Basin was finalized in August 2000 and does not appear to have been updated (EPA).

According to EPA's website, the Idaho Supreme Court ruled that the Metals TMDL was null and void because rule making procedures were not followed and an implementation plan is not being developed for the TMDL.

9.3.5.1.4 Impaired Idaho Reach of the Spokane River

The Spokane River Dissolved Oxygen TMDL (Ecology, 2010) is based on water quality modeling of the Spokane River performed by EPA. EPA is using the model results to draft NPDES permits for the point source discharges in Idaho. The Spokane River Dissolved Oxygen TMDL was summarized in Section 9.3.3. A lawsuit settlement agreement in 2002 indicated DEQ was scheduled to develop a TMDL for the Idaho portion of the Spokane River in 2007. DEQ's 2010 Integrated Report (approved by EPA on September 29, 2011) identifies the Spokane River from Coeur d'Alene Lake to Post Falls Dam on the 303(d) list for phosphorus, cadmium, lead, and zinc. The beneficial uses for this reach include aquatic life (salmonid spawning), recreation (primary contact recreation), water supply (domestic water supply), and aesthetics (applies to all waters of the state). DEQ has identified this reach of the Spokane River as "Waters of the State for which a TMDL is needed."

9.3.5.1.5 Site Specific Water Quality Standard

Site-specific surface water quality criteria are in IDAPA 58 Title 1, Chapter 2, Section 275. Site-specific criteria may be developed if:

- Resident species of a water body are more or less sensitive than those species used to develop a water quality criterion.
- Biological availability and/or toxicity of a pollutant may be altered due to differences between the physicochemical characteristics of the water in a water body and the laboratory water used in developing a water quality criterion (e.g., alkalinity, hardness, pH, salinity, total organic carbon, suspended solids, turbidity, natural complexing, fate and transport water, or temperature).
- The affect of seasonality on the physicochemical characteristics of a water body and subsequent effects on biological availability and/or toxicity of a pollutant may justify seasonally dependent site-specific criteria.
- Water quality criteria may be derived to protect and maintain existing ambient water quality.
- Other factors or combinations of factors that upon review of the Department may warrant modifications to the criteria.

9.3.6 Recycled Water (formerly Wastewater Reclamation and Reuse)

The City of Coeur d'Alene has recognized the opportunity to use recycled water. Recycled water use provides several benefits including removal of a nutrient load from the river. It also provides an alternate water source for commercial or industrial users, which in turn could reduce demand on other water supplies.

During the 2010-2011 low phosphorus demonstration pilot testing, the City embarked on a recycled water demonstration project. A permit application was submitted to DEQ and planning had commenced to convey recycled water from the Low Phosphorus Demonstration Pilot Testing Facility membrane filtration units to the recycled water demonstration irrigation sites.

9.3.6.1 Idaho Regulatory Guidance

The State of Idaho's regulations for recycled water were updated in 2011 – IDAPA 58.01.17 *Recycled Water Rules.* The *Idaho Guidance for Recycled Water* is an additional document that helps interpret and apply the recycled water rules and is referenced when planning recycled water uses. A comparison of effluent quality for Class A , B and C recycled water is shown in Table 9-10. The 2011 changes to the recycled water rules are summarized as follows:

- Landscape irrigation with recycled water at the wastewater treatment plant does not require a permit so long as the NPDES permit is still met and the public is restricted from the irrigated site.
- The plan of operation required for the recycled water facility must describe in detail the operation, maintenance, and management of the facility.
- Permits must comply with the Ground Water Quality Rule with supporting documentation provided in the permit application.
- New permits will be effective for a fixed term of no more than ten years
- The waiver specific to coagulation has been removed and replaced with a general section for waivers (940) that says waivers can be granted on a case-by-case basis. The rules

reference the State of California Treatment Technology Report for Recycled Water that has the specific requirements for waiving the coagulation requirement.

- Turbidity differences between Class A and Class B recycled water, and between the types of filtration applied are as follows:
  - Class A:
    - Granular/cloth media: Not to exceed (NTE) 2 NTU, Max 5 NTU
    - Membrane: NTE 0.2 NTU; Max 0.5 NTU
  - Class B:
    - Granular or cloth media: NTE 5 NTU, Max 10 NTU
- New piping shall be colored purple, Pantone 512, 522, or equivalent
- Groundwater Recharge: site location and aquifer storage time shall be based on site-specific modeling and any source water assessment zone studies for public drinking water wells in the area. The owners of groundwater recharge sites must control the ownership of the down gradient area to prohibit future wells from being drilled in the impact zone of the groundwater recharge system.
- The requirement to be located a minimum of 1,000 feet from any down gradient drinking water wells and six months of travel time have been removed from the new rules.

Table 9-10: Class A, B, and C Recycled Water Treatment Requirements

Quality and Treatment Requirements			
	Class A	**Class B**	**Class C**
Disinfection	Chorine CT = 450 mg-min/L, contact time >90 min Or 5-log virus inactivation total coliform =2.2 cfu/100 mL – 7-day median 23 CFU/100 mL maximum	Chlorine residual at point of compliance > 1 mg/L after 30 minutes at peak flow total coliform =2.2 cfu/100 mL – 7-day median 23 CFU/100 mL maximum	Total coliform =23 cfu/100 mL – 5-day median 230 CFU/100 mL maximum
Turbidity	Sand, granular or cloth media 2 NTU daily mean; 5 NTU instantaneous maximum Membrane filtration 0.2 NTU aily mean; 0.5 NTU instantaneous maximum	5 NTU daily mean; 10 NTU instantaneous maximum	
Nitrogen	TN < 30 mg/L – irrigation TN < 10 mg/L – recharge		
pH	6.0-9.0		
BOD	BOD5 < 10 mg/L – irrigation BOD5 < 5 mg/L - recharge		

Idaho Recycled Water Rules (April 2011)

9.4 Existing Resources

9.4.1 Introduction

This section includes a description of the treatment system upgrades and new construction at the Coeur d'Alene Wastewater Treatment Plant since the Phase 4B headworks and influent pumping improvements were completed in 2007. Improvements include integrated fixed film activated sludge (IFAS) for near-term ammonia nitrogen reduction, waste secondary solids thickening and additional ammonia nitrogen reduction capacity added in Phase 5A, the Low Phosphorus Demonstration Pilot Testing Facility for operation in 2010 and 2011, and additional digester volume and associated solids handling improvements in Phase 5B. A new administration/laboratory building and a collections systems/maintenance garage was constructed in Phase 5B.

9.4.2 Expansion History

9.4.2.1 Near Term Ammonia Nitrogen Reduction Improvements

In anticipation of lower ammonia nitrogen limits when flows reach 4.2 mgd, the City chose to install IFAS in the existing solids contact tanks to increase ammonia nitrogen reduction since major ammonia nitrogen reduction improvements were postponed, pending the completion of the Spokane River dissolved oxygen TMDL. IFAS was selected based on the purported ability to enhance the ammonia nitrogen reduction capacity of the existing system with moderate costs, quick installation, and without the need for new process tankage. In 2008, the City installed five IFAS modules in the solids contact tank, prior to the summer low-ammonia nitrogen permit season.

9.4.2.2 Phase 5A Ammonia Nitrogen Reduction Improvements

Concurrent with the 2009 Wastewater Facility Plan Amendment, the City of Coeur d'Alene faced the potential for new effluent discharge permit requirements associated with the evolving draft dissolved oxygen TMDL for the Spokane River prepared by Washington Department of Ecology. At the same time, the biological treatment system at the Coeur d'Alene wastewater treatment plant was operating at, or above, the estimated capacity of the facility to meet current effluent discharge permit limits for ammonia nitrogen. Near-term treatment process modifications were required to enhance the City's ability to comply with permit limits.

Based on the effluent ammonia nitrogen performance results from the 2008 summer season, an additional five IFAS modules (30,000 square feet (ft^2) of media) were installed in 2009 as a part of the Phase 5A Ammonia Nitrogen Reduction Improvements. Four of these additional modules were placed in a portion of the sludge reaeration zone and one module was placed in the solids contact zone. In order to provide enough ammonia nitrogen to sustain a healthy population of nitrifying bacteria, an option to divert the trickling filter effluent to the sludge reaeration tank was added. This trickling filter effluent piping modification effectively resulted in conversion of a portion of the sludge reaeration volume to solids contract volume. Additionally, the centrate return operation from the centrifuge and belt filter press was modified from once per day to an equalized return rate return over an entire day during the ammonia nitrogen permit season.

The 2009 Wastewater Facility Plan Amendment included a recommendation for secondary sludge thickening with a dissolved air flotation unit or a rotary screen thickener (RST). As a part of Phase 5A, an RST was installed in a temporary location to determine its ability to thicken waste secondary sludge and separate secondary sludge from co-thickening with primary sludge in the gravity thickeners.

9.4.2.3 Low Phosphorus Demonstration Pilot Testing Facility

Following the 2006 pilot testing program that was discussed in the 2009 Wastewater Facility Plan Amendment, the City elected to conduct a two year Low Phosphorus Demonstration Pilot program that included three technologies: a membrane bioreactor (MBR), a tertiary membrane filter (TMF), and a tertiary dual stage continuous upflow sand filter (dual-stage filter).

For pilot testing, primary effluent is fed to the MBR pilot plant and secondary effluent is fed to the TMF and the dual-stage filters. The TMF and dual-stage filter influent total phosphorus concentration changes seasonally. This is because alum is added to the mainstream plant secondary process to reduce the effluent total phosphorus below approximately 1 mg/L during the phosphorus removal season.

Online monitoring for the influent and effluent streams on each pilot treatment system provides real-time information on process operation. Online monitoring includes orthophosphate, nitrate, ammonia nitrogen, turbidity, pH, suspended solids and dissolved oxygen. Composite samples are taken daily on the influent and effluent of each system and analyzed in the treatment plant laboratory. Laboratory analysis includes total phosphorus, orthophosphate, soluble total phosphorus, soluble orthophosphate, total suspended solids, chemical oxygen demand, biochemical oxygen demand, alkalinity, total Kjeldahl nitrogen, ammonia nitrogen and nitrate.

9.4.2.4 Phase 5B Solids Processing Improvements

The majority of the Phase 5B expansion was focused on solids processing improvements. The project included a new Administration/ Laboratory Building, a new Collections Maintenance Garage, Digester Control Building, Biogas Control Building, Anaerobic Digester 5, utilidor expansion, utility electrical power changes, instrumentation and control for the new buildings and equipment. A summary of what was included in each component is itemized as follows:

- Administration/ Laboratory Building that includes offices for Wastewater Department Staff, meeting and training rooms, library, control/SCADA room, sample receiving and pretreatment area, wet chemistry lab area, data entry and laboratory technician office area, mechanical room, electrical room, men’s and women’s restrooms, and janitor closet.
- Collections Maintenance Garage for centralized collection system maintenance operations and includes heated bays with shop area, men’s and women’s locker rooms and restrooms, break/lunch room, and SCADA room for the collections system.
- Digester Control Building with space for current and future sludge pumping, sludge heating, sludge recirculation, hot water recirculation, chemical storage and feeding equipment, and motor control center (MCC) and control room with space for Phase 5 and future loads.
- Biogas Control Building with space for current and future gas safety equipment, regulators, meters, sediment tanks and drips traps, and space for gas scrubbing equipment for future cogeneration systems.

- Anaerobic Digester 5 including a cupola containing gas handling equipment.
- Utilidor extension to accommodate yard piping and electrical raceways for Phase 5 and future solids handling structures.
- Electrical power distribution for the new buildings and equipment.
- Instrumentation and Controls for the new buildings and equipment.

9.4.2.5 Wastewater Treatment Plant Unit Processes

The existing full-scale plant treatment process unit design criteria for the Coeur d'Alene Facility are summarized in Table 4-1 of the 2009 Wastewater Facility Plan Amendment. Unit processes that have been added or upgraded since the 2009 Wastewater Facility Plan Amendment are summarized in Table 9-11. An aerial photograph with labels for major facilities is presented in Figure 9-17.

Table 9-11. Process Unit Design Criteria

Trickling Filter		
	Integrated Fixed Film Activated Sludge	
	Number of modules	10
	IFAS BioWeb surface area, total, sf	60,000
Solids Handling Processes		
	Centrate Storage Tank (previously Anaerobic Digester 1)	
	Diameter, ft	30
	Sidewater Depth, ft	19
	Volume, gal	100,000
	Mixing Type	none
	Rotary Screen Thickener	
	Number of units	2
	Capacity, each, gpm	130
	Anaerobic Digesters	
	Number (1 active and online, 3 in standby)	4
	Total Volume, gallons	732,000
	Anaerobic Digester 5	
	Diameter, ft	50
	Sidewater Depth, ft	30
	Volume, gallons	457,000
	Mixing Type	Pumped
	Sludge Storage Tank[1]	
	Diameter, ft	30
	Sidewater Depth, ft	19
	Volume, gal	100,000
	Mixing Type	none

[1]Sludge Storage Tank was excluded from the 2009 Wastewater Facility Plan Amendment and is shown for informational purposes only.

Source: 2009 IFAS Report, Phase 5B Solids Processing Improvements Conformed Construction Document.

1. Electrical Service Entrance
2. Screenings Building
3. Influent Pump Station (IPS)
4. Standby Generator #1
5. Underground Utility Corridor
6. Shop and Garage
7. Operations Control Center
8. Primary Clarifier #2
9. Primary Clarifier #1
10. Gravity Thickener #3
11. Gravity Thickener Control Bldg.
12. Gravity Thickener #2
13. Gravity Thickener #1
14. Anaerobic Digester #3
15. Solids Building
16. Anaerobic Digester #4
17. Sludge Pump House
18. Centrate Storage Tank
19. Sludge Storage Tank
20. Anaerobic Digester #2
21. Centrate Pump Station
22. Pre-aeration/Grit removal
23. Primary Control Building
24. Trickling Filter Pump Station
25. Trickling Filter #1
26. Trickling Filter #2
27. South Compost Bed Biofilter
28. North Compost Bed Biofilter
29. Spare Parts Storage Building
30. Secondary Clarifier #1
31. Storage Building
32. Secondary Control Building
33. Secondary Clarifier #2
34. Solids Contact/Sludge Re-aeration Basin #1
35. Solids Contact/Sludge Re-aeration Basin #2
36. Standby Generator #2
37. Chlorine Contact Tank and Effluent Pump Station
38. Enclosed Storage Building
39. Chlorine Building
40. Chemical System Center
41. Collections Storage Building
42. Temporary RST Building
43. Anaerobic Digester #5
44. Digester Control Building
45. Biogas Building
46. Low Phosphorus Demonstration Facility
47. Collection Maintenance Garage
48. Administration/Laboratory Building

Coeur d'Alene
Wastewater Treatment Plant (May 2011)

Figure 9-17. Coeur d'Alene Wastewater Treatment Plant Facilities – May 2011

9.4.3 Current Operational Requirements

9.4.3.1 Operating Budget

The fiscal year 2010/2011 operating budget for the treatment plant and biosolids composting facility was approximately $5 million. This includes labor, materials, and operational expenses for wastewater and biosolids treatment and the composting facility. Collection system operating expenses, debt service for capital expenses, equipment replacement funds, and interagency transfers are not included in this budget. The current Coeur d'Alene Wastewater Department organizational chart is shown in Figure 9-18.

9.4.3.2 Labor costs

Cost allocations for staff administration, wastewater collections, wastewater treatment, laboratory, compost, and other staff costs are presented in Table 9-12. Labor costs are projected to increase by approximately three percent per year.

Table 9-12. 2010/2011 Annual Labor Cost

Job Description	Salary	Total Compensation
Administration	$323,522	$474,267
Wastewater Collections	$334,988	$519,250
Wastewater Treatment	$357,676	$535,996
Lab	$147,179	$222,619
Compost	$99,320	$142,200
Other costs (1)	$184,492	$233,990
Total	**$1,447,177**	**$2,128,322**

(1) Includes retiree health insurance, part-time, overtime, sick leave repurchase, and unemployment.

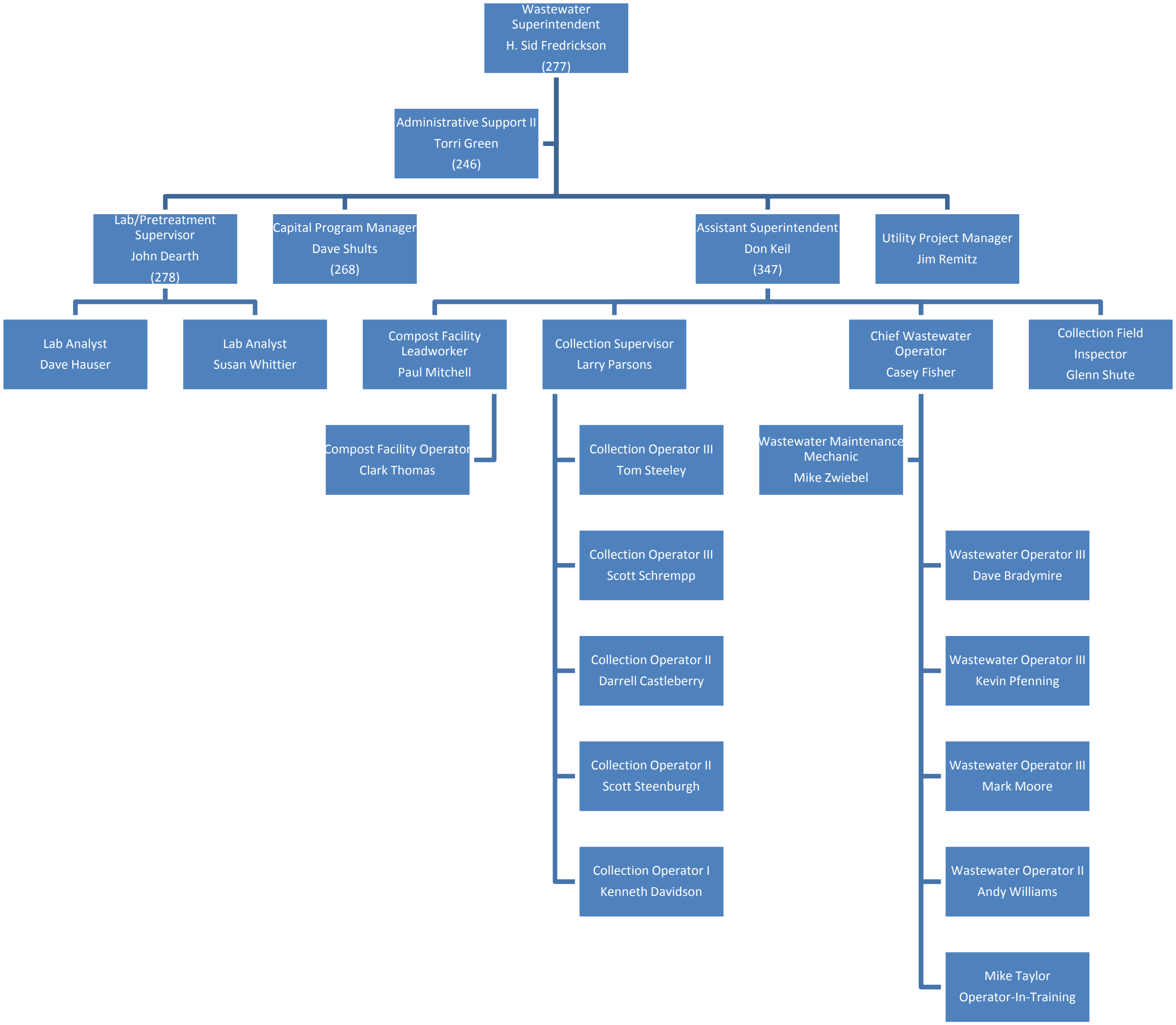

Figure 9-18. City of Coeur d'Alene Wastewater Department Organization Chart

9.5 Alternatives Evaluation

9.5.1 Introduction

The 2009 Wastewater Facility Plan Amendment evaluated three liquid stream alternatives for the Phase 5C Liquid Stream Improvements (6 mgd) and future growth.. The process alternatives were based on revisions to the 2000 Facility Plan, results from the 2006 pilot testing program, and preliminary screening of alternatives for the City's ability to meet low effluent phosphorus limits. The three liquid stream tertiary technologies from the 2009 Wastewater Facility Plan Amendment are the focus of further evaluation in the City's 2010-2011 Low Phosphorus Demonstration Pilot Test.

9.5.2 Future Secondary Treatment Options

No additional secondary treatment options were evaluated since the 2009 Wastewater Facility Plan Amendment.

9.5.3 Future Tertiary Treatment Options

The future tertiary treatment technologies were initially tested and evaluated by the City following the 2006 pilot testing program. Three tertiary treatment options were selected for evaluation in the 2009 Wastewater Facility Plan Amendment. No additional tertiary treatment options were evaluated for this update.

9.5.4 Process Alternatives

9.5.4.1 Revised Phosphorus and Nitrogen Removal Configuration

The process configuration proposed in the 2000 Wastewater Facility Plan included conventional activated sludge in parallel with the existing TF/SC treatment train. Phosphorus removal was included in the design to reach an effluent concentration less than 1 mg/L with alum addition. The process configuration was revised in the 2009 Wastewater Facility Plan Amendment based on significantly lower effluent phosphorus limits listed in the 2007 draft NPDES permit. The updated process configurations included tertiary filtration, or an MBR, for very low effluent phosphorus concentrations and capacity expansion.

9.5.4.2 Preliminary Screening of Alternatives

A preliminary screening of alternatives was completed prior to the alternatives evaluation in the 2009 Wastewater Facility Plan Amendment. No additional treatment process alternative screening was completed for this update.

9.5.4.3 Alternative 1 – Existing TF/SC and New CAS with Bio-P, Chem P, and TF/SC-CAS Tertiary Membrane Filtration

Alternative 1 includes the existing TF/SC plant followed by tertiary membrane filtration and a parallel conventional activated sludge plant operated with biological phosphorus removal and chemical addition followed by tertiary membrane filtration. This alternative is described in detail in Chapter 5 of the 2009 Wastewater Facility Plan Amendment.

9.5.4.4 Alternative 2 – Existing TF/SC and CAS with Bio-P, Chem P, and TF/SC-CAS Tertiary Dual-Stage Upflow Sand Filtration

Alternative 2 includes the existing TF/SC plant followed by tertiary upflow sand filtration and a parallel conventional activated sludge plant operated with biological phosphorus removal and chemical addition followed by tertiary upflow sand filtration. This alternative is described in detail in Chapter 5 of the 2009 Wastewater Facility Plan Amendment. Several terms have been used to describe this alternative in recent reports and presentations including upflow media filtration, upflow sand filtration, and moving bed filtration.

9.5.4.5 Alternative 3 – Existing TF/SC and MBR with Bio-P, Chem P, and TF/SC Tertiary Membrane Filtration– Revised

Alternative 3 includes the existing TF/SC plant followed by tertiary membrane filtration and a parallel membrane bioreactor operated with biological phosphorus removal and chemical addition upstream of the tertiary membrane filters. This alternative is described in detail in Chapter 5 of the 2009 Wastewater Facility Plan Amendment.

9.5.5 Low Phosphorus Demonstration Pilot Testing Facility

The 2009 Wastewater Facility Plan Amendment included three liquid stream process alternatives for phosphorus removal: a tertiary membrane filtration system, a dual-stage continuous upflow sand filter, and a membrane bioreactor. These three alternatives rely on the capability and operability of three treatment technologies. These technologies were tested in the City of Coeur d'Alene Low Phosphorus Demonstration Pilot Testing Facility. The results of the pilot testing, including effluent characteristics, operability, stress testing, and reliability impact the full-scale design decisions for each of the three liquid process alternatives.

The objectives of the pilot testing program were to assess the reliability of the technologies to operate under diurnal and seasonal flows and loads, to provide a training platform for operators, and to allow a degree of process optimization prior to full-scale design. The final effluent permit limits were unknown when the pilot testing program commenced and have yet to be finalized in a new NPDES discharge permit. However, effluent phosphorus of 0.050 mg/L on a long term average basis was considered to be the limit of treatment technology. The final 2010 version of Spokane River Dissolved Oxygen TMDL was based on a water quality modeling scenario selected by Ecology with a 0.036 mg/L effluent TP for Idaho dischargers. The effluent quality from the technologies tested in the pilot was reviewed on both a monthly and seasonal average basis. These averages were compared to the range of effluent limits from 0.036 mg/L to 0.050 mg/L to understand the ability of each technology to meet these low limits. A summary of the technologies and the pilot results is provided in the following sections. The complete pilot results and analysis are presented in the Draft City of Coeur d'Alene Low Phosphorus Demonstration Pilot Testing Facility Report (2012).

9.5.5.1 Tertiary Membrane Filtration

During the Low Phosphorus Demonstration Pilot Testing, a tertiary membrane filtration process was operated representing Alternative 1 in the 2009 Wastewater Facility Plan Amendment. Two operational modes were used for the TMF: conventional filtration and recirculation modes. In conventional filtration mode, the membrane tank is periodically drained during backwash events and accumulated solids are wasted. In recirculation mode, the chemical solids generated are retained in the tank to maintain a TSS inventory. This solids accumulation is thought to allow for a longer contact time with chemical sludge for additional adsorption and complexation, resulting in greater phosphorus removal performance.

Average effluent total phosphorus performance for the tertiary membrane filter ranged from 0.020 to 0.195 mg/L on a monthly basis. Following a startup period, the TMF system produced effluent phosphorus with a concentration less than 0.050 mg/L, with an alum dose of 50 mg/L, in some of the months of operation. The monthly average effluent total phosphorus and orthophosphate concentrations from July 2010 through June 2011 are presented in Table 9-13.

Table 9-13. Monthly Average TMF Effluent TP and OP Concentrations

Month	Effluent TP (mg/L)	Effluent OP (mg/L)
Jul-10	0.051	0.046
Aug-10	0.017	0.016
Sep-10	0.020	0.016
Oct-10	0.022	0.017
Nov-10	TMF off in November	
Dec-10	0.059	0.050
Jan-11	0.106	0.096
Feb-11	0.195	0.185
Mar-11	0.081	0.067
Apr-11	0.049	0.039
May-11	0.013	0.012
June-11	0.039	0.038

Operation in recirculation mode also provides a benefit to ammonia nitrogen reduction by providing an environment to grow and sustain a population of nitrifying bacteria. As a result, effluent ammonia nitrogen concentrations are also reduced in the TMF system. Nitrification was observed primarily in the TMF during the summer months(August to October 2010 and June through July 2011) when wastewater temperatures were warmer (Figure 9-19). The solids inventory was found to be directly proportionate to the nitrification performance. The data in Table 9-14 show that an increase in mixing tank solids concentration also increases nitrification with a commensurate reduction in effluent ammonia nitrogen concentrations.

Table 9-14. Estimated TMF Nitrification Performance

Month	Influent NH4-N (mg/L)	Effluent NH4-N (mg/L)	NH4-N Removal (mg/L)	Mixing Tank TSS (mg/L)	Temperature (°C)
August 2010	8.2	4.6	3.6	1350	24
September 2010	7.8	2.2	5.6	2000	23
October 2010	7.8	2.7	5.1	2600	21
June 2011	13.2	3.8	9.4	2100	13
July 2011	8.8	2.5	6.3	3100	14

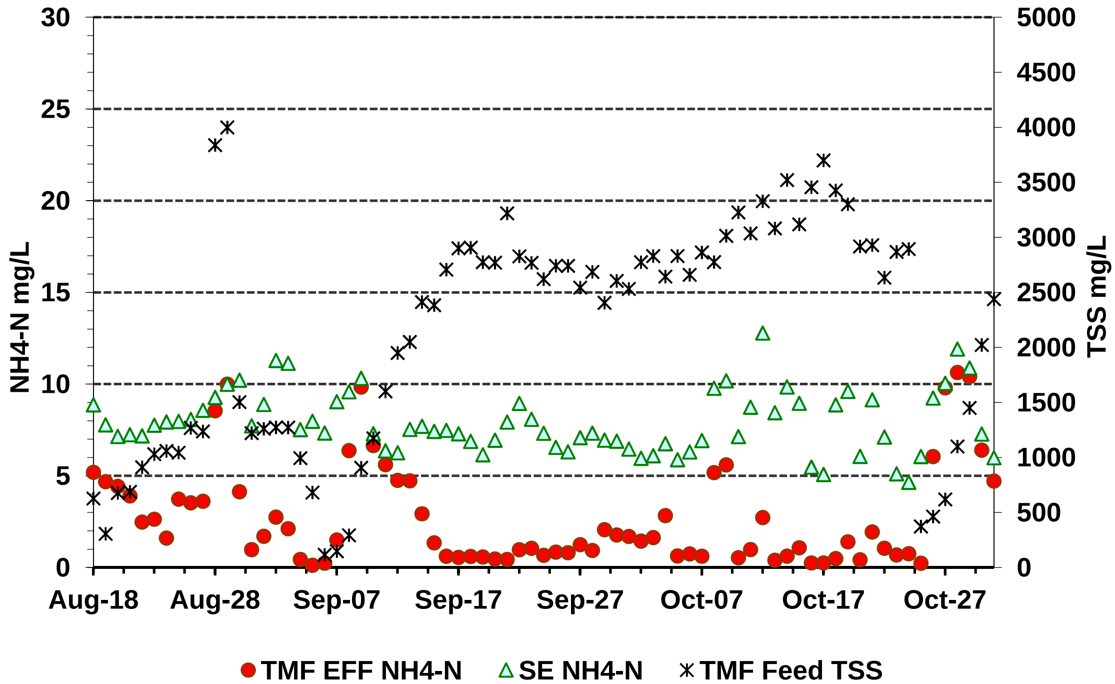

Figure 9-19. TMF Nitrification Observation

While nitrification performance varied in the pilot TMF process, a full scale application is expected to perform significantly better since the process will be designed specifically to achieve nitrification. In particular, the full-scale aeration system will be designed for adequate capacity to meet nitrification process demands (the pilot facility only provided air through the membrane air scour system) and chemical feed facilities would be provided to supplement alkalinity.

9.5.5.2 Dual-Stage Continuous Upflow Sand Filter

A dual-stage upflow sand media tertiary filtration process option representing Alternative 2 in the 2009 Wastewater Facility Plan Amendment was operated in the Low Phosphorus Demonstration Testing Facility. Average effluent total performance for the dual-stage filter ranged from 0.020 to 0.173 mg/L on a monthly basis. (Table 9-15). Secondary process upsets, operations issues, and pilot-related equipment challenges led to process upsets in the pilot that increased the monthly average effluent phosphorus concentration. In addition to normal operation as a tertiary filter, the system was also tested at peak flows with the filters operating in series and parallel. High phosphorus load and high solids load testing were also conducted. These stressing parameters were used to understand how this system would react in adverse conditions that could occur in normal, full scale conditions.

While the dual-stage filters were capable of impressive phosphorus removal performance during some periods, operations and process issues presented challenges during pilot testing. The sand beds had a tendency to bind during high solids events or when chemical dosing was increased. During these bed binding events, operators had difficulty sustaining bed turnover using the automated operation and often had to manually purge the bed by forcing air into the sand. While this was successful at a small scale in the pilot facility, it would be less feasible in a full-scale installation with many filters.

Table 9-15: Monthly Average Dual-Stage Filter Effluent TP and OP concentrations

Month-Year	Effluent TP (mg/L)	Effluent OP (mg/L)
Jul-10	0.034	0.020
Aug-10	0.025	0.016
Sep-10	0.076	0.048
Oct-10	0.020	0.012
Nov-10	0.070	0.052
Dec-10	0.030	0.020
Jan-11	0.045	0.024
Feb-11	0.031	0.017
Mar-11	0.173	0.125
Apr-11	0.109	0.078
May-11	0.018	0.012
June-11	0.137	0.148

9.5.5.3 Membrane Bioreactor

A membrane bioreactor process option representing Alternative 3 in the 2009 Wastewater Facility Plan Amendment was operated in the Low Phosphorus Demonstration Testing Facility. An MBR is an attractive alternative because it is compact and fits within limited space available for capacity expansion on the plant site while allowing continued development in the surrounding area. , Monthly average effluent total phosphorus and orthophosphate concentrations from the MBR system are shown in Table 9-16 and ranged from 0.034 mg/L to 2 mg/L. The effluent phosphorus in March, April and May of 2011 were less than 0.05 mg/L when the biological process was operated under optimal conditions for enhanced biological phosphorus removal and no chemical addition was required. Even during the spring months with colder wastewater temperatures, the BNR MBR performed very well with a supplemental sodium acetate dose of 30 ppm (as chemical oxygen demand (COD)), without the addition of a metal salt coagulant.

Table 9-16: Monthly Average MBR Effluent TP and OP Concentrations

Month	Effluent TP (mg/L)	Effluent OP (mg/L)
Jul-10	0.107	0.098
Aug-10	0.034	0.020
Sep-10	0.059	0.045
Oct-10	0.210	0.191
Nov-10	1.957	1.969
Dec-10	0.377	0.374
Jan-11	0.118	0.112
Feb-11	0.238	0.229
Mar-11	0.037	0.029
Apr-11	0.043	0.033
May-11	0.044	0.030

9.5.5.4 Summary of Pilot Test Findings

The Low Phosphorus Demonstration Pilot Testing Program has yielded important process performance information that has improved the understanding of both the capabilities and the limitations of the three candidate technologies. Completion of the testing program promises to result in a more complete portrayal of technology performance upon which the City plans to base decisions on improvements for the full-scale plant.

Each of the three technologies investigated in the pilot testing program produced high quality effluent and reduced phosphorus to very low concentrations. Each of the treatment processes produced effluent phosphorus concentrations at, or below, the levels generally considered to be the limits of treatment technology in the range of 0.050 mg/L to 0.100 mg/L.

Each of the three candidate technologies exhibited unique performance characteristics and responses to the stress testing challenges presented in the demonstration program. Equipment system performance, electrical and mechanical component malfunctions, etc. also varied between to candidate systems.

9.5.6 Staged Implementation of Phase 5C

The City plans to implement Phase 5C improvements for low effluent phosphorus in incremental steps that scale-up pilot testing results to the full-scale facility. This is necessary because some pilot study treatment process concepts that appear most advantageous for the City to apply to the future facility are also so new that they have not been applied to full-scale treatment facilities in the past. Consequently, proving out pilot testing process concepts at a larger scale, but at less than full treatment capacity for the entire plant, is a prudent approach. The initial plan for incremental implementation of Phase 5C is to construct a post-pilot Phase 5C.1 project that consists of an initial module of tertiary membrane filters with nitrification in the chemical mixing tank for a targeted capacity of 0.5 to 1.0 mgd. In order to accomplish this, a portion of the full plant flow will pass through the tertiary membrane system and blend with the remainder of the plant effluent prior to discharge. Additional process tankage and membrane modules are provided in future sub-phases as additional capacity up to the design maximum monthly flow is needed.

The post-pilot Phase 5C configuration is a revision to the Phase 5C configuration presented in the 2009 Wastewater Facility Plan Amendment and is described further in the recommended plan in Section 9.7.

9.5.7 Staffing Needs for an Advanced Water Reclamation Facility

Required additional staffing for the Phase 5C improvements are based on increased operations and maintenance tasks and increased analytical skills to monitor, control, and adjust the advanced treatment processes. Estimates of the operations and maintenance (O&M) tasks and hours for the new tertiary system have been updated based on the pilot facility operations experience and are summarized in Table 9-17.

Table 9-17. Routine O&M Tasks for Phase 5

	Daily (hours)	Weekly (hours)	Monthly (hours)	Total Annual Hours
Visual Observation: of chemical feed systems, BNR, IFAS, and Filtration	2			732
Logs and Recordkeeping	0.5			183
General Housekeeping		6		312
Chemical Feed System Maintenance: Lubrication, pump head replacement, valve repairs			8	96
Process air collection and treatment housekeeping and repairs			15	180
Process performance monitoring (SCADA trends, etc)	2			732
Chemical Dosage Check		0.5		26
Chemical Delivery: Alum and Ferric			2	24
BNR – Instrumentation maintenance		4		208
BNR – Preventive Maintenance: Oil and greasing on recycle pumps, valves, blowers			32	384
IFAS™ Maintenance			3	40
Monitoring cleaning cycles	0.5			183
Perform membrane recovery clean: assumes in tank cleaning quarterly. Estimate given on monthly basis.			8	96
Membrane chemical cleaning system operation		4		208
Membrane Preventive Maintenance: Lubrication of blowers, valves, compressors and pumps.			12	144
Membrane integrity repairs: module pinning or cartridge/cassette replacement			8	96
Membrane Corrective Maintenance: allowance for mechanical equipment over a 10-year lifecycle.			40	480
Membrane Replacement			24	288
Fine Screening Preventive Maintenance: Lubrication of rotational equipment, belt or drive adjustments		2		104
Fine Screening Corrective Maintenance		4		208
Total Annual Labor Hours				**~4,700**
Total Additional Staffing (FTE's based on 1900 hours/year after vacation, sick leave, and training)				**2.5**

9.5.8 Financial Requirements

A Phase 5 Preliminary Design Report (PDR) (May 2009) was completed following the 2009 Wastewater Facility Plan Amendment to develop more detailed site layouts, yard piping, process sizing, and other details necessary for solids handling improvements to proceed. As a part of the preliminary design, the cost opinions for the three liquid stream alternatives were revised and updated. The revised capital costs presented in the PDR are summarized in Table 9-18 for comparison of the three alternatives as they represent the potential cost of Phase 5C Liquid Stream Improvements should the City determine the post-pilot Phase 5C is not viable. The cost opinion for the recommended post-pilot Phase 5C improvements is provided in Section 7.

The differences between each of the liquid stream alternatives are associated with secondary treatment and tertiary treatment facilities. Common features to all three alternatives include primary treatment and primary clarification facilities, chemical storage and feed systems, and solids handling systems. The liquid stream Alternatives No. 1 and No. 2 include expansion of the secondary clarification facilities and RSS/WSS pumping. Alternative No. 3 utilizes membrane filters for liquid-solid separation in the new secondary treatment train and therefore does not require additional secondary clarification capacity.

Capital costs in Table 9-18 are expressed in 2011 dollars, escalated from the May 2009 dollars presented in the 2009 PDR. The accuracy of all costs are planning level and future market conditions and cost of materials cannot be controlled. These cost opinions are approximations made without detailed engineering and limited site-specific data. Nevertheless, preliminary site layouts and facility modeling were used for preparation of the cost estimates.

The basis of the cost estimates and sources of construction data are summarized in general as follows:

- Basis of unit pricing is RS Means, 1st quarter 2009 using Open Shop rates for the Spokane, WA and Coeur d'Alene, ID area. (Wage rates were compared to the Davis Bacon wage decision for the area and wages used are comparable to those listed for the corresponding labor category.)
    - May 2009 dollars were escalated to December 2011 dollars using the Engineering News Record 20-City construction cost index.
- Recent construction costs for other, similar facilities, adjusted to regional market conditions and 2009 dollars.
- Equipment pricing from manufacturers, including installation, structure and housing costs.
- Allied costs for contractor mobilization/bonds and insurance, contractor markup, contractor profit, contingencies, engineering, legal, and fiscal elements.

Alternatives No. 1 and No. 2 require a significantly greater site footprint that will necessitate re-location of the existing Riverside Interceptor pipeline to accommodate the full build out of the new process train within the available land area.

Table 9-18. Opinion of Probable Project Cost for Liquid Stream Alternatives

	Liquid Stream Alternative No. 1 (Existing TFSC + CAS and MF) Amount	Liquid Stream Alternative No. 2 (Existing TFSC + MBF2) Amount	Liquid Stream Alternative No. 3 (Existing TFSC and MF + MBR) Amount
Total Phase 5C Probable Project Cost	$49,000,000	$52,000,000	$55,000,000
Range of Accuracy (+20%)	$ 59,000,000	$62,000,000	$66,000,000
Range of Accuracy (-10%)	$ 44,000,000	$47,000,000	$50,000,000

9.6 Site Master Planning

9.6.1 Introduction

Recent improvements to the wastewater treatment plant have been designed with architectural features that provide a visual buffer between the treatment plant and surrounding neighborhood, including the adjacent Education Corridor. The goal is to continue planning for the development of a functional wastewater treatment plant site with perimeter buffers, visual screening, and architectural features for a compatible transition to the surrounding community.

9.6.1.1 Buffers

Visual buffers which separate the wastewater treatment plant interior from the adjacent neighborhood include the Administration Building, the Collections Maintenance Garage, the Digester Control Building, the Primary Clarifier Covers, the Headworks Building, and the Influent Pump Station.

9.6.2 Site Master Planning Process

The 2000 Wastewater Facility Plan and 2009 Wastewater Facility Plan Amendment included substantial site planning information that still remains valid.

9.6.3 Historical Site Master Planning

Additional site planning workshops have not been completed since the 2009 Wastewater Facility Plan Amendment.

9.6.4 Treatment Plant Land Use and Zoning

The treatment plant site encompasses approximately 11 acres of which 7 acres include the existing treatment process, administration/laboratory, collections maintenance garage, and storage structures. Each of the wastewater site parcels are zoned for Commercial C-17. The setback requirements for Commercial C-17 zoning are summarized in Table 9-19.

Table 9-19. Commercial C-17 Zoning Setback Requirements

Location	Setback (feet)
Front yard	20
Side yard	10
Side yard/street	20
Rear yard	20

9.6.5 Transitions in Land Use

Existing land uses to the south and east of the wastewater treatment plant are currently in transition. Hubbard Avenue, River Street, College Drive and Academic Way have been re-aligned and paved through this area to allow better traffic access. There are also plans for 14 parcels in this area for development. It is not known at this time what development will occur on these sites but it will likely be related to the Education Corridor.

9.6.6 Wastewater Treatment Plant Site Analysis

A discussion of existing site characteristics and the surrounding neighborhood with considerations for potential future changes are presented in the following sections.

9.6.6.1 North

In 2011, the Centennial Trail was re-routed along the top of the Spokane River flood control berm to the north of the existing treatment facility, south of the Harbor Center building, as a component of the Educational Corridor street improvements. Bike and pedestrian traffic on the trail is substantial.

9.6.6.2 West

Re-alignment of the Centennial Trail continued along the berm west of the wastewater treatment plant site. The connection from the north to this west trail alignment will need to be modified in a future construction project to remove the portion of the trail that bisects the treatment plant site.

9.6.6.2.1 Flood Control

The treatment plant is located immediately adjacent to an existing Spokane River levee owned and maintained by the City of Coeur d'Alene that provides flood risk reduction for areas of the City including the project site. FEMA is requiring all levee owners to evaluate the condition of their levees with respect to stability, seepage control, erosion protection and freeboard in order to obtain certification that the levee will meet the requirements of 44 CFR Part 65.10. Since the 2009 Wastewater Facility Plan Amendment, the United States Army Corps of Engineers has contacted the City of Coeur d'Alene regarding the removal of trees, shrubs, and other vegetation on flood control berms within the City, including the flood control berm adjacent to the wastewater treatment facility. The City Council is currently considering its options for addressing this issue with the Corps.

9.6.6.3 East

The log storage yard that previously dominated the east edge of the wastewater treatment plant is now owned by North Idaho College and serves as a parking lot. The Hubbard Avenue alignment adjacent to the plant and Academic Way that serves Harbor Center have been re-aligned. Also, a new traffic light was constructed at the intersection of Northwest Boulevard and Hubbard Avenue that will control traffic into and out of the Education Corridor and past the east side of the wastewater treatment plant.

9.6.6.3.1 Treatment Plant Site Access Considerations

Multiple access and transportation issues exist near the wastewater treatment plant including the treatment plant, Harbor Center, North Idaho College, and Lewis-Clark State College.

9.6.6.3.2 Northwest Boulevard / Hubbard Avenue

A traffic signal has been constructed at the intersection at Hubbard and Northwest Boulevard in 2011 to control traffic and improve safety.

Hubbard Avenue was reconstructed in 2011 to build a two-way street with three roundabouts from Northwest Boulevard along the east side of the wastewater treatment plant through the Stimson Mill site to River Road.

9.6.6.3.3 University of Idaho Education Corridor Master Plan

The University of Idaho Education Corridor Master Plan has not been updated since the 2009 Wastewater Facility Plan Amendment. North Idaho College is moving forward with construction of improved access and development of the former Stimson Mill site.

9.6.6.4 South

The Stimson Mill has been closed and demolished. The area to the south of the wastewater treatment plant has been purchased by North Idaho College and redevelopment as part of the Education Corridor project is underway. The former mill site borders the south and east boundaries of the wastewater treatment plant. This area is currently being used as overflow parking for North Idaho College.

9.6.7 Wastewater Treatment Facilities Requirements

The requirement for space within the wastewater treatment plant site is for facilities of adequate size to meet existing and future regulatory requirements and capacity expansion.

9.6.7.1 Impact of Plant Site Encroachments

The Union Pacific railroad tracks have been removed and the land that formerly bisected the wastewater treatment plant site is now owned by the City. The City has constructed a new Administration Building and Collections/Maintenance Garage east of the former railroad alignment.

The re-alignment of Hubbard Avenue and Academic Way have encroached on the property boundaries of the wastewater treatment plant property. This has reduced the area available for perimeter buffer and aesthetic improvements along this key line of sight from Northwest Boulevard. These improvements will also increase traffic along Hubbard Avenue.

9.6.8 Wastewater Treatment Plant Site Layouts

Alternative treatment plant site layouts were developed in the 2009 Wastewater Facility Plan Amendment in 3 mgd increments for the three alternatives. A revised site layout is provided in this facility plan update and is included in the recommended plan in Section 9.7.

Facilities constructed for solids stream improvements as a part of Phase 5B in 2010 and 2011 are shown on the revised site layout in Section 9.7. Note that during the Phase 5B construction project, the Burlington Northern Santa Fe railroad tracks were removed.

9.7 Recommended Plan

9.7.1 Introduction

This section presents the recommended plan based on the alternatives developed in the 2009 Wastewater Facility Plan Amendment and this 2012 update. Sections 9.4, 9.5, and 9.6 provide the background and detail for the recommendation. The recommended plan continues to encompass water conservation, advanced wastewater treatment, recycled water production, and site planning concepts that are included in the 2009 Wastewater Facility Plan Amendment and is updated based on enhanced process concepts resulting from the Low Phosphorus Demonstration Pilot Testing Facility.

9.7.1.1 Liquid Treatment Processes

The recommended plan for implementation of liquid treatment process improvements in Phase 5C includes conversion of the existing wastewater treatment plant into an advanced water reclamation facility up through the original design capacity for the TF/SC facility. The original capacity of the TF/SC facility was 6 mgd prior to being de-rated to 4.2 mgd to account for necessary ammonia nitrogen reduction capacity in 2004. The recommended approach for this facility plan update consists of up to 6 mgd of tertiary membrane filtration of secondary effluent from the existing TF/SC facility during Phase 5. The recommended schematic for the post-pilot Phase 5C process configuration is shown in Figure 9-20.

If it is determined that this treatment process train is not viable based on a performance assessment of Phase 5C.1 improvements, the City may decide the most viable approach is the base treatment alternative of 3 mgd TF/SC followed by TMF and parallel 3 mgd MBR or CAS with effluent filtration as presented in the 2009 Wastewater Facility Plan Amendment.

A parallel activated sludge treatment process will be added in future phases to increase capacity from 6 mgd to 9 mgd (Phase 6) and 12 mgd (Phase 7). Some upgrades to enhance the reliability and redundancy of the existing TF/SC treatment processes are also expected.

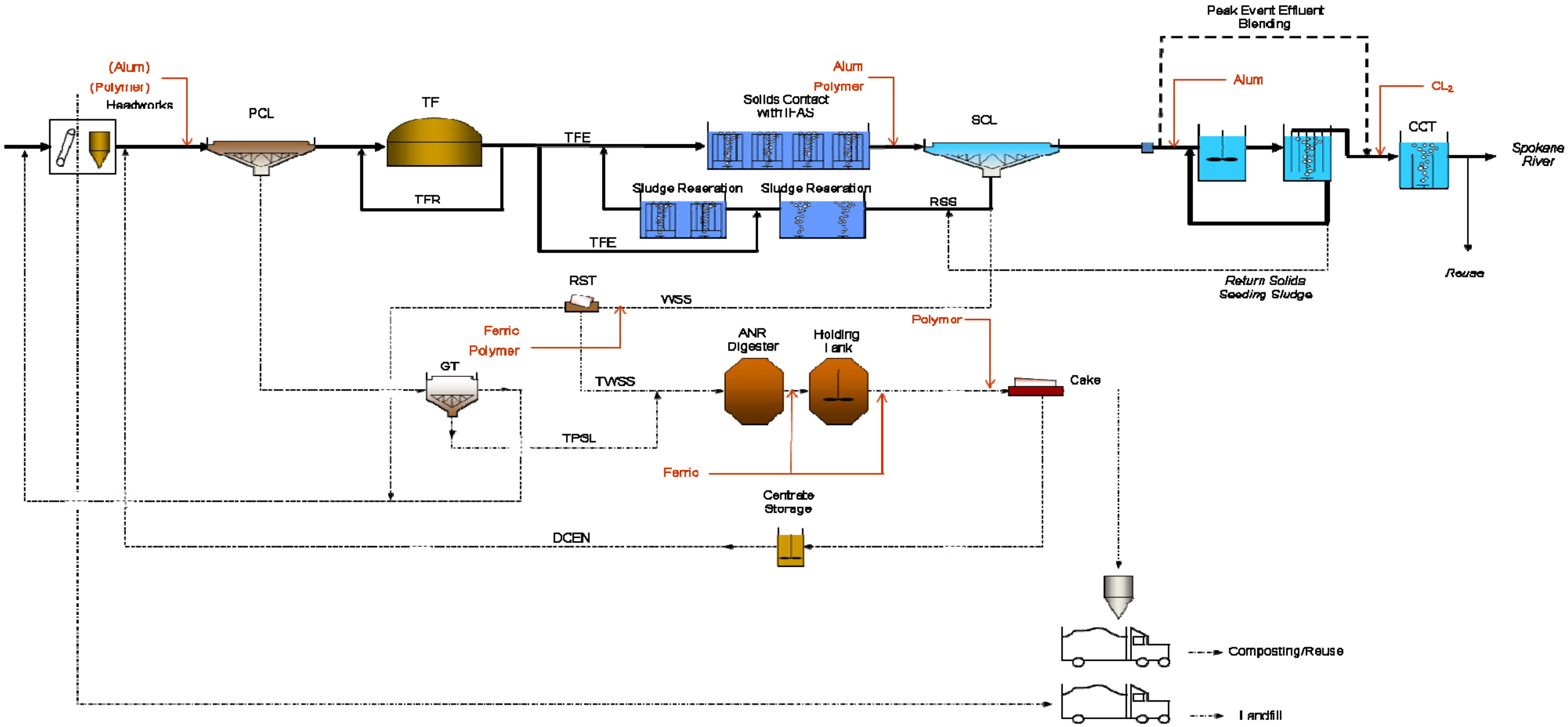

Figure 9-20: Phase 5C Process Schematic

9.7.1.1.1 Phase 5C.1 – Near-Term Improvements

The near term phase of improvements will include up to 1 mgd of tertiary membrane filtration of secondary effluent from the TF/SC plant. Secondary effluent will be pumped from the secondary clarifiers to the chemical mixing tank and through the membrane tanks. The TMF permeate will be blended with secondary effluent, disinfected, and discharged to the river. Increased nitrification capacity is added in a combination of improvements including the chemical mixing tank, the expanded solids contact tank, and by seeding of nitrifying bacteria from solids wasting from the membrane tank. A simplified flow schematic is shown in Figure 9-21.

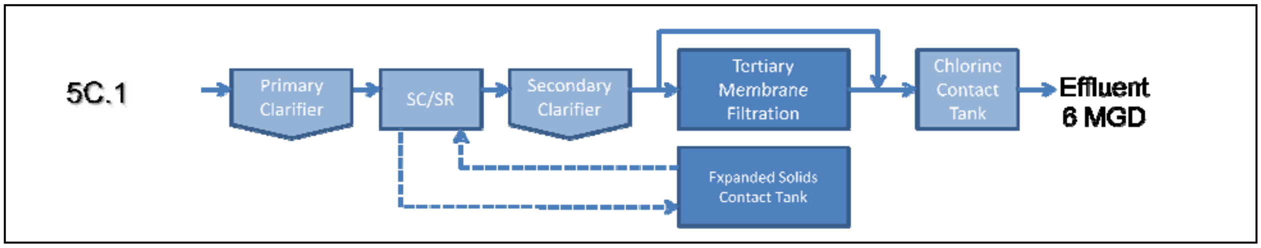

Figure 9-21. Phase 5C.1 Flow Schematic.

The TMF system includes a chemical mixing tank, membrane tanks, pumping (feed, return, permeate, wasting), piping, blowers, and chemical feed systems. The membrane tanks will be designed with the ability to add up to 6 mgd capacity of membrane modules. A chemical mixing tank will be constructed upstream of the membrane tank in a similar configuration to that of the Low Phosphorus Pilot Demonstration Testing Facility. The chemical mixing tank will include aeration and be sized for nitrification to provide additional ammonia nitrogen reduction.

The chemical mixing tank will be subdivided into compartments in Phase 5C.1. Approximately 33 percent of the volume will operate as chemical mixing for up to 1 mgd of TMF and the remainder will be used to provide expanded solids contact volume for additional nitrification in the secondary system. Solids wasting from the membrane tanks will seed nitrifying bacteria to the solids contact process to further enhance ammonia nitrogen reduction. Alum will be added upstream of the mixing tank for phosphorus removal. Return solids from the membrane tanks will be recirculated to the chemical mixing tank to accumulate and maintain a solids inventory. The solids inventory will allow the growth of nitrifying bacteria as well as supplement phosphorus removal by metal coagulant complexation with aged solids.

Biological treatment of peak wet weather flows will continue through the TF/SC process and the secondary effluent from peak flows, which exceed the peak membrane flux, will be blended with tertiary membrane permeate. Only the equipment required for 1 mgd tertiary flows will be installed in Phase 5C.1. Additional equipment will be provided in subsequent phases to increase capacity advanced phosphorus removal treatment.

9.7.1.1.2 Phase 5C – 6 MGD Tertiary Filtration

Full-scale implementation of Phase 5C will be completed incrementally to reduce the economic impact to the City and to provide for periods of performance evaluation prior to committing to more costly improvements for the full future plant capacity. Phasing also is appropriate because 6 mgd of capacity is not needed immediately since current wastewater flows are less than 4 mgd. Near-term increases in wastewater flow are expected to grow at a rate less than that observed over the past 5 to 10 year. Subsequent phasing could include expansion of the membrane operating system and other equipment to increase the TMF capacity from 1 mgd up to 5 mgd in Phase 5C.2. This would bring the total capacity of the low effluent phosphorus system to slightly greater than the current flow rate. Future growth will eventually require expansion up to 6 mgd and can be accomplished in a future Phase 5C.3. The basic process flow diagram planned for Phase 5C is shown in Figure 9-22.

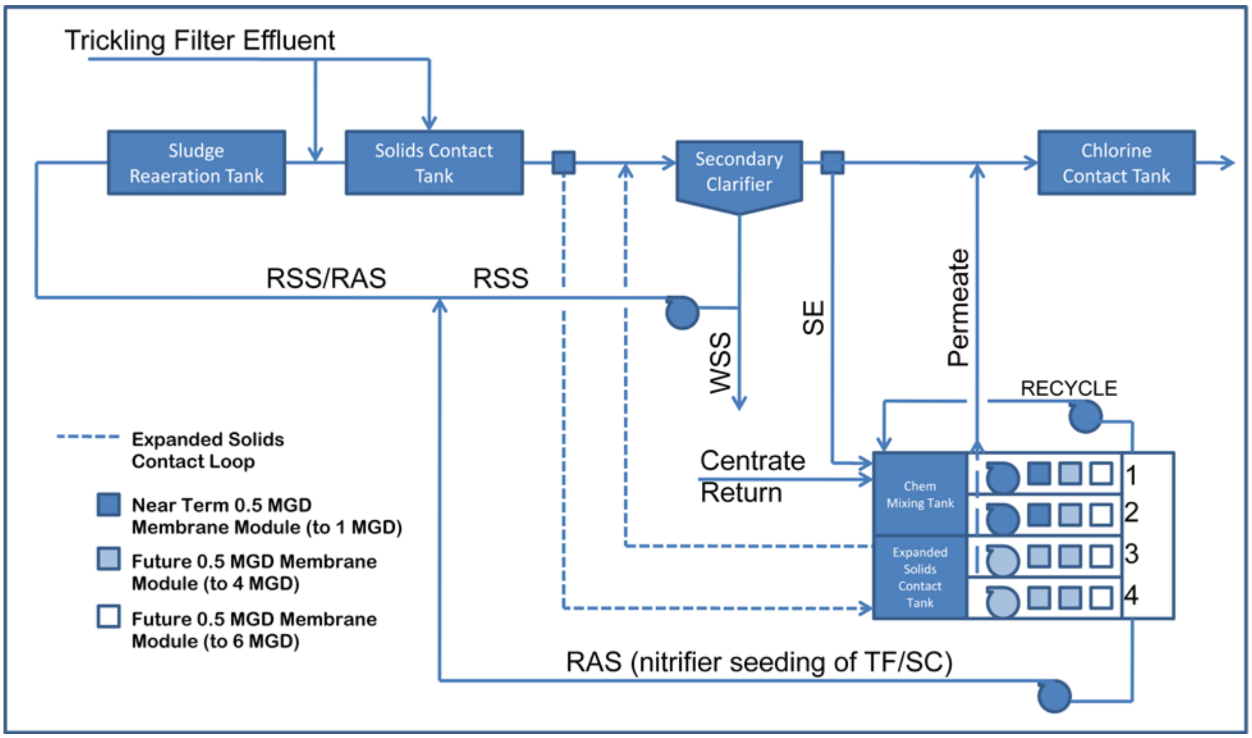

Figure 9-22. Basic Process Flow Diagram

9.7.1.1.2.1 Staged Implementation of Phase 5C

Recommended facilities for the staged implementation of Phase 5C are presented below:

- Phase 5C.1 - Membrane capacity to filter an annual average flow rate of approximately 1 mgd.
  - Secondary Effluent Pumping Station
  - Chemical Mixing Tank
  - Membrane Tanks
  - Tertiary Membranes (initial 1 mgd capacity target)
  - Equipment Building and Process Equipment
  - Chemical Feed System

- Phase 5C.2 - Additional membrane capacity to filter an annual average flow rate of approximately 5 mgd and redundant process units.
    - Primary Clarifier with Cover
    - Secondary Clarifier
    - Additional Tertiary Membranes (additional capacity target of approximately 4 mgd)
    - Additional Process Equipment
    - Additional Chemical Feed System and Storage
- Phase 5C.3 - Additional membrane capacity to filter an annual average flow rate of 6 mgd.
    - Additional Chemical Mixing Tank
    - Additional Tertiary Membranes (additional capacity target of approximately 1 mgd)
    - Additional Process Equipment

9.7.1.2 Predicted Effluent Quality with Incremental Improvements

The final effluent quality from the Coeur d'Alene treatment plant will be dependent upon the flow through the tertiary membrane filtration system. The effluent quality will improve as the Phase 5C facilities are added since flow through the membranes increases with each incremental addition of membrane capacity. The effluent total phosphorus concentration and load depends on the concentration and volume of blended secondary effluent and tertiary membrane permeate.

The assumptions for secondary effluent and TMF effluent concentrations are summarized in Table 9-20. These concentrations were used to calculate the predicted effluent quality for each phase.

Table 9-20: Assumed Secondary Effluent and TMF Effluent Concentrations

Parameter	Secondary Effluent (mg/L)	TMF Effluent (mg/L)	Remarks
Total Phosphorus	1	0.05	Secondary effluent - 95th percentile of average daily effluent TP concentration during the current phosphorus removal season from 2006-2011 TMF Effluent – assumed removal to the limit of technology
CBOD	7.2	2	Secondary effluent – 95th percentile of average daily effluent CBOD concentration from 2006-2011 TMF Effluent – limit of detection for CBOD
Ammonia Nitrogen	7-15	0.3-0.5	Range of concentrations varies by month based on reduced performance in the spring and improved removal during the summer months.

The three scenarios explored in this analysis are summarized as follows:

- Phase 5C.1 - Near-term flows with membrane capacity to filter an annual average flow rate of approximately 1 mgd.
  - The predicted effluent ammonia nitrogen is expected to be less than 7.4 mg/L (current permit limit for flow greater than 4.2 mgd).
  - In July, the predicted *monthly average* effluent ammonia nitrogen concentration is expected to be less than the Preliminary Draft NPDES permit *monthly average* toxicity limit for ammonia.
  - The predicted *seasonal average* effluent ammonia nitrogen concentration for the anticipated ammonia season (March 1 through October 31) is expected to exceed the Preliminary Draft NPDES permit limit. Phase 5C.2 improvements will be required to meet the anticipated NPDES ammonia limits.
- Phase 5C.2 - Mid-term flows with additional membrane capacity to filter an annual average flow rate of approximately 5 mgd.
  - The predicted *seasonal average* effluent ammonia load (March-October average) is expected to be less than the anticipated permit limit.
  - The predicted *seasonal average* effluent phosphorus and CBOD loads are expected to be less than the anticipated permit limit.
- Phase 5C.3 - Long-term flows with additional membrane capacity to filter an annual average flow rate of 6 mgd.

- The predicted *seasonal average* effluent ammonia load (March-October average) is expected to be much less than the anticipated permit limit.
- The predicted *seasonal average* effluent phosphorus and CBOD loads are expected to be less than the anticipated permit limit.

Table 9-21 includes a summary of predicted effluent total phosphorus, CBOD, and ammonia nitrogen performance with implementation of Phase 5C improvements through three incremental stages. Nearly all of the plant flow must pass through the membrane system to meet the anticipated phosphorus limits. Based on the Preliminary Draft NPDES permit shared with this City in November 2011, it is anticipated that the permit requirements will include seasonal average effluent limitations and monthly and daily toxicity requirements for ammonia based on the Spokane River dissolved oxygen TMDL. The predicted monthly average effluent quality values are based on the assumptions presented in Table 9-20.

Table 9-21. Predicted Effluent Quality for Total Phosphorus, CBOD, and Ammonia Nitrogen

		Phase 5C.1		Phase 5C.2		Phase 5C.3	
		Existing Flows and 1 mgd TMF		Existing Flows and 5 mgd TMF		Future Flows and 6 mgd TMF	
Plant Flow		4 mgd		5 mgd		6 mgd	
Flow to new tertiary membrane filtration		1 mgd		5 mgd		6 mgd	
	Equivalent Effluent load (lb/d)	**Effluent Load (lb/d)**	**Effluent Conc. (mg/L)**	**Effluent Load (lb/d)**	**Effluent Conc. (mg/L)**	**Effluent Load (lb/d)**	**Effluent Conc. (mg/L)**
Phosphorus							
February through October	3.2	25	0.76	2.1	0.05	2.5	0.05
CBOD							
February and March	226	197	5.9	83	2.0	100	2.0
April through October	203	197	5.9	67	2.0	100	2.0
Ammonia							
March	272	379	11.4	20.9	0.5	25	0.5
April	272	379	11.4	20.9	0.5	25	0.5
May	272	329	9.9	16.7	0.4	20	0.4
June	272	253	7.6	12.5	0.3	15	0.3
July	272	253	7.6	12.5	0.3	15	0.3
August	272	203	6.1	12.5	0.3	15	0.3
September	272	178	5.3	12.5	0.3	15	0.3
October	272	253	7.6	12.5	0.3	15	0.3

The assumptions used to estimate the peak hour flow event effluent quality are summarized in Table 9-22. Results of the predicted effluent quality mass balance during a peak hour flow event are summarized in Table 9-23 for each increment of Phase 5C.

Table 9-22: Assumed Secondary Effluent and TMF Effluent Concentrations during Peak Hour Flow Events

Parameter	Secondary Effluent (mg/L)	TMF Effluent (mg/L)	Remarks
Total Phosphorus	2	0.2	Secondary effluent – maximum daily effluent concentration during current phosphorus removal season (2006-2011) TMF Effluent – maximum daily effluent concentration during Pilot operation[1]
CBOD	30	5	Secondary effluent – maximum concentration assuming reduced performance of the primary and secondary clarifiers (all units online) TMF Effluent – assuming reduced removal during a storm event
Ammonia Nitrogen	20	0.5	Secondary effluent – maximum daily effluent concentration during current ammonia removal season (2006-2011) TMF Effluent – nitrification is maintained in the TMF system

[1]Pilot data during operation with recirculation and no stress testing.

Table 9-23. Predicted Effluent Quality Under Peak Flow Conditions with Secondary Effluent Blending

	Phase 5C.1	Phase 5C.2	Phase 5C.3
Annual Average Flow	4 mgd	5 mgd	6 mgd
Peak Flow[1]	12.7 mgd	15.9 mgd	19.0 mgd
Peak Flow through TMF[2]	1.75 mgd	8.75 mgd	10.5 mgd
Secondary Effluent Blended Flow	10.95 mgd	7.15 mgd	8.5 mgd
Plant Effluent	**Effluent Concentration (mg/L)**		
Total Phosphorus	1.75	1.0	1.0
CBOD	27	16	16
Ammonia Nitrogen	17.3	9.3	9.2

[1]: The peak hour flow peaking factor was 3.17 based on the 2009 PDR.
[2]: Flux peaking factor of 1.75 was used to determine peak flow through TMF:

The addition of membrane treatment capacity in Phase 5C.2 and Phase 5C.3 decreases the blended effluent concentration for all there parameters. The increased concentrations in the final effluent drives the limited number of storm events that can occur in a season while maintaining the seasonal load limit and is discussed further in the following section.

9.7.1.3 Peak Flow Management

The TMF system will filter flow rates up through those associated with the peak membrane flux rate (approximately 1.75 times the average flow rate). Wet weather driven flows that exceed the peak capacity of the membrane system will continue through the secondary treatment system and secondary effluent will be blended with membrane permeate prior to disinfection and discharge. Data for evaluation of historic peak hourly flows were limited, however influent flows were measured every 15 minutes during the operation of the Low Phosphorus Demonstration Pilot Testing Facility. A peak influent flow of 18 mgd from an approximately five hour duration storm event was recorded during June of 2010, although there are some questions about the accuracy of the peak flow measurement since it exceeded the average by a factor of four to five times. Nonetheless, measurements of this recorded event highlight the significance of rainfall dependent inflow to the collection system and the need for peak flow management strategies in both the collection system and the treatment plant.

The full Phase 5C tertiary membrane filtration system will be designed for an annual average flow of 6 mgd. Additional membrane modules will be added in increments to the initial capacity in Phase 5C.1 through future stages of Phase 5C up to a maximum monthly flow of approximately 6 mgd. This modular expansion is shown in the simplified process flow diagram. The plan is for the peak flow through the membrane system to be based on the allowable peak flux for the manufacturer’s membranes without over-building membrane capacity for the relatively short duration storm influenced peak flows that Coeur d’Alene experiences. At a representative flux peaking factor of 1.75 times average, the resulting peak membrane system capacity is 10.5 mgd. For a theoretical peak storm influenced flow of 19 mgd, the tertiary and secondary effluents will be blended to avoid overloading the membrane process. The duration that blending can occur, while remaining within the effluent discharge permit limits, is restricted due to the higher phosphorus concentrations in secondary effluent blended with membrane permeate.

The membrane type, flux peaking factors, flow split, and tolerable storm duration for maintaining permit compliance will be described in detail in the Phase 5C Preliminary Engineering Report. An initial evaluation of total phosphorus, ammonia nitrogen, and CBOD was conducted to understand which constituent will control if secondary effluent blending is necessary during short duration peak storm flows. The assumed secondary effluent and TMF effluent quality during storm events is shown in Table 9-22. The maximum blending duration during storm events was calculated based on the assumption that the blended effluent seasonal load for these constituents will remain below seasonal loads that were calculated from the CE-QUAL-W2 water quality modeling scenarios for equivalency with the TMDL. The maximum blending duration during storm events based on these assumptions is summarized in Table 9-24.

Under the Phase 5C process configuration, effluent phosphorus controls the allowable blending duration in a season.

Table 9-24. Maximum Secondary Effluent Blending Duration

Plant Flow[1]	19.0 mgd
TMF Flow[2]	10.5 mgd
Secondary Effluent Blended Flow	8.5 mgd
Phosphorus Removal Season	February 1 through October 31
Maximum Blending Duration	11 hours
Ammonia Nitrogen Season	March 1 through October 31
Maximum Blending Duration	268 hours
CBOD Season	February 1 through October 31
Maximum Blending Duration	73 hours
[1]Plant flow is the theoretical peak hour flow presented in the 2009 Wastewater Facility Plan Amendment based on an annual average flow of 6.0 mgd [2]TMF peak flow is based on a flux peaking factor of 1.75 and an annual average flow of 6.0 mgd	

9.7.1.4 Preliminary Site Layout

A preliminary site layout of the planned Phase 5C improvements is shown in Figure 9-23. The required footprint was developed in the 2009 Preliminary Design Report and updated based on revisions to the peak flow management strategy and post-pilot process configuration described in this 2012 update.

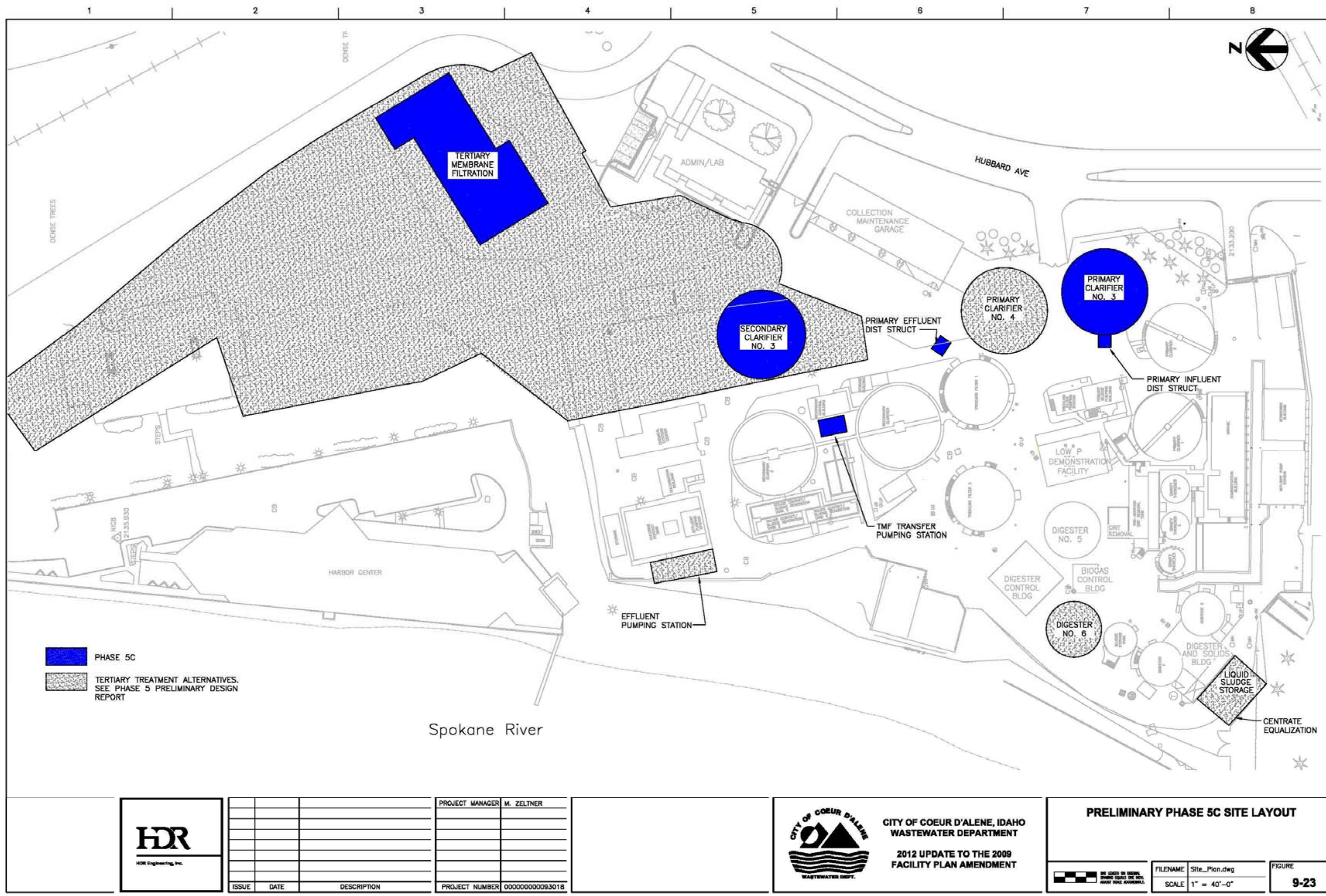

Figure 9-23. Preliminary Phase 5C Site Layout

9.7.2 Phase 5C Improvements Pre-design, Detailed Design and Construction

The 2009 Wastewater Facility Plan Amendment envisioned the Phase 5 program to be implemented in three stages: Phase 5A Ammonia Enhancements, Phase 5B Solids Stream, and Phase 5C Liquid Stream. Phase 5A and Phase 5B were completed between 2008 and 2011. While Phase 5C could continue between $41 million and $61 million based on the three liquid stream alternatives described in the 2009 Wastewater Facility Plan Amendment, it will be further segregated into smaller increments based on the post-pilot process configuration to balance capital costs and potentially lessen the impact on customer rates.

Phase 5C.1 will include approximately 1 mgd of tertiary membrane filtration capacity designed to allow incremental capacity additions. Future stages of Phase 5C (e.g., Phase 5C.2 and Phase 5C.3) will include installation of the remaining membrane operating system components, permeate pumping, and associated equipment.

9.7.2.1 Preliminary Engineering

The preliminary engineering for Phase 5C will provide the basis for detailed design and is focused on refining the facility plan concepts. Historically, the preliminary design phase has taken one to two years. However, due to the aggressive nature of this implementation schedule and the need for near-term ammonia nitrogen reduction capacity, the preliminary engineering for Phase 5C has been compressed to approximately four months. The preliminary engineering report will include the following components based on the requirements in the State of Idaho Wastewater Rules (2011) administered by the DEQ:

- Design objectives
- Liquids and solids mass balance
- Design criteria
- Site evaluation and layout
- Hydraulic profile
- Process units
    - Tertiary filtration equipment
    - Aeration
    - Chemical feed systems
    - Tertiary membrane filtration feed pumping
    - Power requirements
    - Electrical supply
    - Instrumentation and controls
    - Redundancy
- Provisions for future phases

- Summary opinion of probable cost

9.7.2.2 Detailed Design, Contractor Bidding and Award, Construction Phase, Testing, Startup and Commissioning

Detailed design is focused on producing plans and specifications that will serve as contract documents for bidding and selection of a general contractor to construct the facilities improvements. Detailed design for Phase 5C.1 will occur over approximately six months to begin construction in 2012. The performance of the Phase 5C.1 improvements will be assessed after one year of operation. Following this assessment period, the City will determine whether to continue expanding the TMF with solids recirculation (post-pilot Phase 5C configuration) or revert to a treatment process configuration described in the 2009 Wastewater Facility Plan Amendment. Design criteria for the remaining 5C improvements will also be established during the one-year assessment period. The design of Phase 5C is estimated to be 20 months, allowing an additional four months for Idaho DEQ review. The complete schedule for the overall Coeur d'Alene program is shown in Figure 9-24.

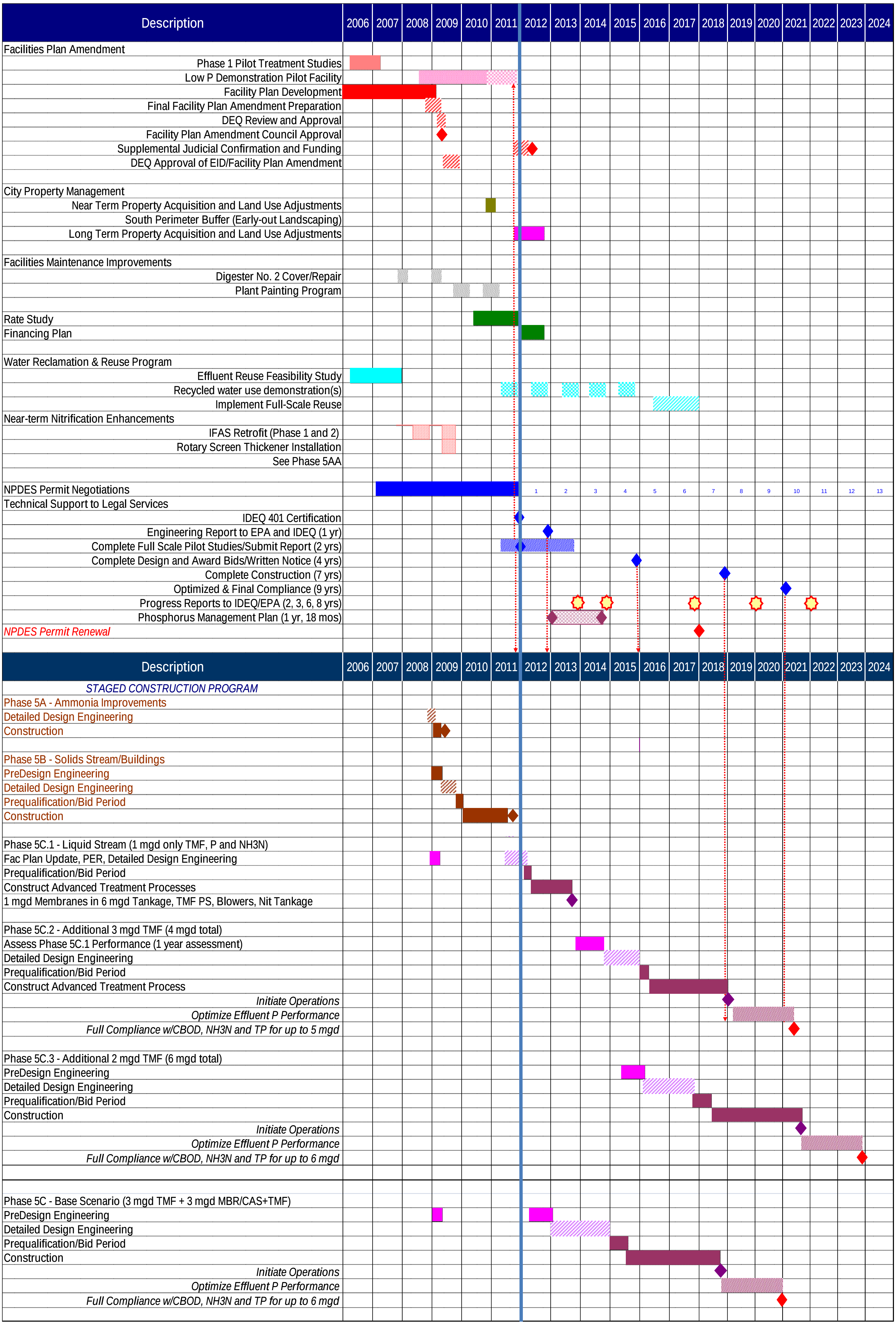

Figure 9-24. Phase 5 Program Schedule

9.7.3 Program Costs

An updated estimate of Phase 5C project costs based on the updated recommended plan is presented in Table 9-25. The basis for the cost opinion is:

- Components from the 2009 PDR were included and the costs were escalated from May 2009 to December 2011 using the ENR 20-City construction cost index.
- Tertiary filtration cost opinion was revised to reflect the configuration following pilot operation.
- Parallel treatment facilities were removed from Phase 5C

Table 9-25. Opinion of Estimated Phase 5C Costs Escalated from 2009 PDR Costs

FUTURE PHASE 5C PROJECT – POST-PILOT CONFIGURATION			
Phase 5C – Liquid Stream Improvements	Phase 5C.1	Phase 5C.2	Phase 5C.3
Primary Clarifier		$680,000	
Primary Clarifier Cover		$690,000	
Chemical Storage and Feed	$30,000	$100,000	
Secondary Clarifier		$1,790,000	
Tertiary Filtration (membrane)	$6,000,000	$5,400,000	$1,600,000
Subtotal	$6,030,000	$8,660,000	$1,600,000
Miscellaneous Items Not Itemized (15%)	$900,000	$1,290,000	$240,000
Subtotal	$6,930,000	$9,950,000	$1,840,000
Escalation to Mid-point of Construction[1]	$-	$1,830,000	$540,000
Subtotal	$6,930,000	$11,780,000	$2,380,000
Mobilization, Bonds and Insurance (10%)	$680,000	$1,160,000	$230,000
Contractor's Overhead and Profit (10%)	$680,000	$1,160,000	$230,000
Subtotal	$8,290,000	$14,100,000	$2,840,000
Engineering legal and fiscal (25%)	$2,070,000	$3,530,000	$710,000
Subtotal	$10,360,000	$17,630,000	$3,550,000
Range of Accuracy -10%	$9,320,000	$15,870,000	$3,200,000
Range of Accuracy +20%	$12,430,000	$21,160,000	$4,260,000
PHASE 5C TOTAL		**$31,540,000**	
Range of Accuracy -10%		**$28,390,000**	
Range of Accuracy +20%		**$37,850,000**	

1 Projection based on ENR CCI average increase over last 7 years of 3.6 percent per year.

9.8 REFERENCES

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